JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1857.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

(Continued from page 158.)

2. The *second objection* is, that the dams though only 8 feet high from pool to pool, will cause a vast increase in the elevation of the great floods, and consequently seriously damage property along the river, and destroy cities, mills, &c., &c. Much stress has been laid upon this objection: so much, indeed, that Mr. Morris has ventured to announce an opinion that it is fatal to the plan. Granting nothing in this stage of the question on this point, the great practical question to be decided is, will such dams create any material additional rise in times of *high freshets?*

Mr. Morris has, to some extent, investigated it, but he confines his observations mainly to the results of a particular case, on the Potomac River, and to one particular flood. He presents a profile of that river, showing the flood line of an 18 feet flood, and its effect with an 18 feet dam; from which it appears, that the increased rise at the upper end of the pool was 5 feet, and at the dam 9½ feet. The natural declivity of the stream being 2½ feet per mile, or two and a half times greater than the Upper Ohio, and *seven* times greater than the Lower Ohio. He then assumes, that "with similar dams on the Ohio, we must expect as a necessary consequence to augment the height of the river floods at least from *five* to *ten* feet; and with the impeded discharge these dams would have in a slackwater navigation from the others necessarily back-

ing their waters against them, there is a strong probability that the augmentation of the floods *would be even greater.*"

Did Mr. Morris pursue this branch of the subject far enough? The writer has frequently been called upon to rebut the apprehensions of non-professional parties in regard to the effect of moderately high dams upon high freshets, but it is rare for an engineer to take this position. The difference in the natural fall of the stream immediately above the pool has an important bearing upon the effect of a sudden flood, such as he describes. It must have descended upon the pool much more rapidly on account of that greater declivity. But upon that same stream imagine a flood of three times the height of the dam, or 54 feet high above the natural river, would that have raised the water 5 to 10 feet higher? Yet this would be only equivalent to a 42 feet flood with the 14 feet dams of the Ohio; and what would be the *additional rise* in such a flood? Something depends upon the suddenness or slowness of the rise. No unbending formula, can by any possibility be made practically applicable to the case; but from experience, sustained by some calculations, a tolerably near approximation to the common and probable result may be had. We must keep the fact in mind, that in such heavy floods the entire body of water in the pool is set in rapid motion, however sluggish it may have been just before, and that the *mass* goes along with the sweeping current, whose velocity is *greatly increased* as it passes the dam, until the entire prism of water has assumed nearly a regular plane along the valley, at comparatively little greater elevation than if the dams had not been there.

On a 42 feet flood on the Ohio at Wheeling, an increase of one foot to the top surface, would add a thousand millions of cubic feet per day to the quantity flowing. The average depth of the proposed pools at low water is to be 10 feet. The total daily flow that would be due to that depth along the unobstructed river, would be only 2,754,000,000 cubic feet, or but $2\frac{3}{4}$ times the flow due to one foot of depth on top of the flood, and this lower prism of water would be flowing onward with more than *double the velocity* due to its original height of ten feet, and with still greater velocity as it passed the dam. The practical operation is such, that could some Titan wrench the dam entirely from its foundation, and hurl it out of sight, the apparent effect upon the flow of water in the river, would be little more than to equalize the velocity, without varying the surface perceptibly. If we should apply to this case, as analogous, the experience obtained on the Potomac, with an 18 feet flood on an 18 feet dam, we should commit a serious error. If we add "5 to 10 feet," or even 5 feet, to the height of the 42 feet flood on the Ohio, it will be found that the quantity of water that would be required to sustain the flowing prism, would be much greater than the quantity contained in the natural flood added to the artificial portion contained in the pools before the flood came: that it is in the nature of things, under any ordinary circumstances, an impossibility. But waiving for the present all theory, let us turn to further results of experience.

Experience on Rivers with Dams.

The writer has had practical experience in constructing and witnessing the operation of a great number of dams, through a period of

thirty years, on the Lehigh, the Schuylkill, the Swatara, the Susquehanna, and the Juniata, east of the Allegheny Mountains; and on the Monongahela, Big Beaver, Little Beaver, French Creek, Kiskiminetas, Shenango, and Conneaut, west of the Mountains. There are other rivers, such as the Youghiougheny, Muskingum, Kentucky, Green, Licking, Miami, White Water, Des Moines, &c., which have been wholly or partially improved by means of dams, concerning which he has a general knowledge.

The facts, derived from actual observation and from reliable testimony, tend to prove, that those persons living along the streams who were once apprehensive of the effects of the floods, have been agreeably disappointed in the actual results.

As before remarked, no single rule can be made practically applicable upon all these different rivers. The experience of the writer will warrant him, however, in suggesting some general limits as to the probable effects on the Ohio River of dams of the height proposed, in connexion with freshets, as they ordinarily occur, as follows: that where the natural freshet should be twice the height of the dams, or 28 feet, the average *additional* rise along the pools of the 14 feet dams, will not exceed one-fifth of the height of the dam; and that where the natural freshet should be three times the height of the dam, or 42 feet, the additional rise along the pool will not exceed one-tenth the height of the dam; and that where the natural freshet should be four times the height of the dam, or 56 feet, the additional rise along the pool will not exceed one-twentieth the height of the dam. The flood of 1832, which rose 62 feet at Cincinnati, was nearly four and a half times the height of the proposed dams; and had they been in existence at the time, the difference in the height of the water could scarcely have been perceived, as *theory* will in part show, and as experience in part teaches.

The very considerable variations in the width of the Ohio at different points, particularly with reference to high floods, and the variable effects of the side floods, from the larger tributaries, dependent largely upon the relative periods of attaining their greatest force, and upon the particular direction their cross currents may take when entering the main river, have far more influence upon the heights of great floods than these dams can have.

Thus, at one time, the Allegheny will send a back current many miles up the Monongahela, over the dam, and at another time, the Monongahela flood will rush for miles up the Allegheny. The Big Beaver, the Licking, the Kanhawa, or the Cumberland, may be in flood, when there is little or no rise in the Ohio proper; or the Upper Ohio may be in flood when all of the streams just named are quite low. The variations in the heights of floods on different parts of the river from these causes, will be greater than the variations or changes caused by the introduction of the dams. On the Monongahela, where 15 feet dams have been in use many years, and where the larger floods previous to their erection may have been about 30 feet, experience does not show any material *additional* rise. In the spring of 1852, these works were subjected to the severest test from two heavy floods which

"occurred in the month of April—the first from the 3d to the 10th, and the second from the 17th to the 24th, which entirely submerged the improvement, and suspended the receipts. These freshets were both greater than any that have preceded them since the memorable flood of 1832, one of them exceeding that, or any other known upon the Monongahela."

Mr. Morris says, "a remarkable point in the experience of the Monongahela navigation, verifies our freshet profile (fig. 5), in a satisfactory manner, and shows its applicability to those rivers, it is this, that whenever the depth of a freshet on the comb of the Monongahela dams is equal to their lift (8 feet), they are always safely passed by steamboats without using the locks, the dams being completely drowned out. Now our profile (fig. 5), shows that about the point near the head of the pool, where another dam would have been placed to continue a slackwater navigation, the depth from the freshet line to the low water level of the pool is 19 feet, or just double the depth on the comb." He is still using the Potomac River as an exemplification. Although what he states respecting the depth of water, and passing of steamboats over the Monongahela dams is correct, its applicability in the particular comparison made, is certainly doubtful. It shows, at all events, that 8 feet *on* the dam, passes as much water as 26 feet depth just below the dam. Still it proves but little when applied to greater floods. Mr. Morris, pursuing the same train of reasoning, founded on the test on the Potomac, as related, continues, "Hence, we may probably generalize thus far at least, *that with a series of equal dams of about ten feet lift succeeding each other in a slackwater navigation, upon a river of uniform section, the freshet depth on the comb of one is just half the backwater raise above that level at the foot of the next;* consequently, whenever the freshet depths of water upon the combs equals the low water lift of the dams, the top water surface of such freshet will present a continuous inclination, or the dams will be drowned out and passable by boats." This appears to have been partially the case on the Potomac in the instance cited, where the fall of the river above the pool is $2\frac{1}{2}$ feet per mile, the dam 18 feet high, and with an 18 feet flood. It is remarkable in the profile showing the surface line of that flood, that it is represented as being actually one foot *higher* half a mile below the upper end of the pool than it was a mile higher up the stream. This may have arisen in part from some local obstacle, and in part may be attributed to the great declivity of the river, causing the freshet to strike the still water at the pool with great velocity, creating a partial reaction. Such would not be the case on the Ohio River, where the average fall is less than 6 inches per mile.

The inclination of the river must be taken into account in generalizing, when we come to consider the effect of a given *quantity* of water passing in a freshet. Thus, to take extreme cases for an illustration, we have two rivers, one falling 1 foot per mile, the other 10 feet per mile; each to be 100 miles long, with dams of 10 feet lift. The first would take ten dams and pools each ten miles in length; the other would have one hundred dams with pools each but one mile in length. Mr. Ellet has very beautifully exemplified that "a flood is but a lengthened wave,"

and this wave would present very different aspects in passing along these two different rivers, in the velocity of its movement, and in the relative height it would take above the pools. A like quantity of water would of course cause a higher rise in the natural stream of gentler declivity; but the question is, how would freshets of *equal height*, for instance, 20 feet over the natural bed, be affected by the dams on these dissimilar rivers? The "lengthened wave," on the gentler stream, would stretch forward, gradually spreading out along each successive pool; whilst in the other, it would be abruptly checked in its impetuous motion ten times as often in the same distance; so that whilst a flood of 20 feet in the gentler stream might not cause an additional rise of more than about 2 feet or less, a flood of 20 feet on the rapid stream might cause an additional rise of 4 feet or more, over each successive short pool. These figures are merely used to verify the reasoning. Retaining these dissimilar streams still in the mind, how would the comparison stand taking an equal *quantity* of water, and comparing its effect on the two? The quantity that would make a natural flow of 20 feet on the gentler stream, would not be more than 7 feet along the rapid stream—both in their natural condition without dams. On the gentler stream, in passing the dams, we should have about 12 feet depth over them, and on the rapid stream, perhaps about 4 feet depth over the combs. But mark, in the case of the gentler stream, the dams as a system, have caused a rise of only two feet above the natural height of the water immediately below each dam, whilst in the case of the rapid stream, the dams, as a system, have caused a rise of 7 feet immediately below each dam. A simple diagram, which almost any one can make, will render this clear.

There are facts connected with freshets in the Schuylkill River at the Fairmount dam, which have a direct bearing. The precise height of the dam is not recollected, but the writer believes it is about 12 feet above low tide, and about six feet above high tide. The river, at the distance of a third of a mile, perhaps, below the dam, is contracted and absolutely confined by bridge abutments to a width of about 350 feet, which operates to some extent in swelling the *high* floods above the bridge, and on the dam. The effect of sudden floods is dependent in part upon the state of the tide. With these premises before us, let us see how floods have operated there?

In January, 1839, a freshet rose to 10⅛ feet on the dam, and below the dam to 13 feet above ordinary high tide, or 19 feet above low tide.

In July, 1850, the water was 8 feet on the dam, and 9¼ feet above ordinary high tide, or 15¼ above low tide.

In September, 1850, it was 10 1/2 feet on the dam, and 13½ feet above ordinary high tide, or 19½ feet above low tide.

We can, in this record, trace the very principle the writer desires to inculcate; although on account of the tidal effect, and the bridge abutments mentioned, the whole rise may have been somewhat greater.

Thus, in the smaller freshet of July, 1850, with 8 feet on the dam, it gave 15¼ feet at low tide; so that at most, the flood in the natural stream below was not quite double of the depth on the dam. The

increase appearing to have been $4\frac{3}{4}$ feet, or not quite 40 per cent. of the height of the dam above low tide, with a flood only one and a third times the height of the dam to low tide.

In the freshet of January, 1839, with $10\frac{1}{8}$ feet on the dam, it gave 19 feet above low tide. The *increase* appearing to have been but $3\frac{1}{8}$ feet, or a fraction over one-fourth of the height of the dam, with a flood only one and seven-twelfths times the height of the dam at low tide.

In the freshet of September, 1850, with $10\frac{11}{12}$ feet on the dam, it gave $19\frac{1}{2}$ feet above low tide. The *increase* appearing to have been $3\frac{5}{12}$ feet, or a trifle more, in proportion, than in the January flood of 1839, with a flood only one and five-eighths times the height of the dam to low tide.

It will be observed, that whilst with a flood one and a third times the height of the dam, the *increase* of rise caused by the dam, &c., was *forty* per cent. of the height of the dam; with another flood, one and seven-twelfths times the height of the dam, said *increase* was but *twenty-six* per cent. Thus, although the larger flood was $3\frac{3}{4}$ feet higher, it only raised the water $2\frac{1}{8}$ feet higher; showing how rapidly the relative effect of the dam diminishes with the augmentation of the floods. Let the same principle be applied to floods of double the height here recorded, and the per centage of the *increase* in question will fall accordingly. It will appear that the assumption of one-fifth of the height of the dam is a very liberal allowance to make for the *increase* on a 28 feet flood on the Ohio River, with dams of 14 feet height; and that one-tenth of said height is a liberal allowance for a 42 feet flood.

The practical conclusion, based on experience, and on such reasoning as the nature of the problem has induced in the mind of the writer, is, that the increase of rise and the consequent increase of damage likely to be caused by dams in the Ohio, with vertical heights from pool to pool, not exceeding 8 feet, when placed in comparison with the magnitude of the interests sought to be benefited, will be deemed insignificant.

The reader will readily perceive that this has no reference to another class of damages also referred to—that is, the actual constant *overflowing* of low bottom land, and of a few mill privileges near the mouths of some of the tributaries. Surveys, or the records of old surveys, will show the extent of this character of damages; but judging in part from the results along the Monongahela, it cannot be a very heavy item.

The writer frankly admits that it is a legitimate objection to the system of locks and dams, that *any* increase of rise should be caused at any time in consequence of the dams, but he feels quite confident that undue importance has been attached to it for want of a full investigation.*

3. *The third objection* is, that the "dams will cause the river to be much more frequently and longer obstructed by ice, and will render ice freshets both more frequent and more dangerous."

In considering this objection we must keep in mind the fact, that in

* For further corroboration of the general theory, and of the practical effect of dams, see Appendix.

comparatively low water, such as is common through the winter, the Ohio River is already but a collection of pools and ripples; the latter being in fact nothing more than flat, sloping, natural dams. When these pools shall be made ten feet deeper by the erection of artificial dams, they will be less liable to freeze, and the ice upon them will be thinner on account of the increased depth in the pools. This is an undeniable natural truth. Again, in low water and freezing weather, the steamers are now forced to cease running *sooner* than they will be after the dams are built, thus leaving the river in undisturbed possession of winter's icy fetters; whereas, with the slackwater in constant operation, there will be no *low water*, and steamers will never cease running until *very severe* freezing should set in.

But without pursuing the theory any further at present, let us look at a practical statement introduced by Mr. Haupt on page 21 of his pamphlet.

He says, "The following statement of the detentions caused by ice on the Monongahela, has been furnished by J. K. Moorhead, Esq., and embraces a period of 10 years, from 1845 to 1854 inclusive.

1845,	Feb. 7 to Feb. 14, inclusive,	8	days.
"	Dec. 7 to Dec. 31, "	25	"
1846,	Jan. 1 to Feb. 1, "	32	"
1847,	Dec. 11 to Dec. 16, "	6	"
1849,	Jan. 10 to Jan. 18, "	9	"
"	Feb. 15 to Feb. 26, "	12	"
1851,	Feb. 1 to Feb. 2, "	2	"
"	Dec. 19 to Dec. 31, "	15	"
1852,	Jan. 12 to Jan. 31, "	20	"
1853,	Jan. 26 to Feb. 1, "	7	"
"	Dec. 28 to Jan. 15, 1854,	19	"
	Total number of days,	155	"

or an average of 15½ days in each year."

Mr. Moorhead also states that, "*the Ohio River has been obstructed by ice nearly the same length of time.*"

Now if the total time per year, namely, 15½ days, were *all* to be considered chargeable to the slackwater navigation, it would not be a very heavy item. Every one can judge how much weight he would allow to the third objection—on the score of the ice question, so far as the period of stopping navigation is concerned.

On the second branch of the objection, that the "ice freshets will be more frequent and more dangerous," we think, on considering the facts, that precisely the reverse will be the case; namely, that they will be *less frequent*, because an equal quantity of water from rains, snows, or thaws, flowing into the deeper and larger pools, would not so readily put the ice in motion, and because the ice being thinner in the first instance, would necessarily be weaker and less dangerous before it commenced moving, and when it did move, it would be immediately broken to pieces at the dam, and go forward in less formidable masses, until it reached its melting or sinking point in the river. Mr. Lothrop, for many years chief engineer on the Monongahela Slackwater, has assured the writer, that such has been the experience there.

The damage from ice, with an experience of 18 years, has not been

serious. Most of the Ohio River is farther south than the Monongahela by several degrees; the most northerly point of the Ohio is only about one-fourth of a degree north of the mouth of the Monongahela. And if a *few* boats on the Monongahela have been able to maintain a perennial navigation lacking but 15½ days per year, will not a much greater number on the Ohio approach that desirable result still more nearly? Theory and experience unite in favor of the assumption that the ice will be less troublesome in every respect after the completion of the slackwater.

4. *The fourth objection* is, that "it will injure the lumber trade and coal business." This is a plain practical objection, which is to be met in a plain practical manner. It is undoubtedly one of great moment. It has been answered in newspaper articles, &c., at different times through a number of years. Mr. Morris, when suggesting in the *Appendix* to his paper, that the writer had committed an oversight in regard to *sluiceways* in connexion with arks, was not perhaps aware of the fact, that the sluiceways proposed in the dams were designed almost wholly for the accommodation of the rafts and arks descending the Allegheny River, which can only run when there is some *rise* in that river, at which time it is presumed they can pass the sluiceways of the dams safely. It was no part of the design, so far as the writer's knowledge extends, to promise a navigation at the sluiceways when there was no corresponding natural navigation on the Allegheny River. The idea was, and is, simply to make such provision for the descending craft of the Allegheny River as would enable them, when they could run to Pittsburgh, to continue on if they so desired, without being compelled to use the locks.

With the proposed extension of the slackwater navigation below Pittsburgh through the whole length of the Ohio River, the idea of using common *arks* for the coal business was exploded, and a system of barges recommended as the proper economical substitute. The day is rapidly approaching, when the scarcity of the right kind of timber will of itself render this step necessary. Arks will be discarded on the Ohio, just as they were on the Lehigh, when the canal was substituted for the descending sluice navigation first constructed. With a good reliable slackwater navigation, the coal business will be augmented to a vast extent, and carried on with an immense saving over the present precarious, costly, and annoying arrangement—if arrangement it can be called. But it is not intended to enter into a detailed investigation of the coal business at this point in the argument. It merely comes up incidentally in the explanation of a misunderstanding in relation to the character and object of the *sluiceway* spoken of as part of the lock and dam system. And yet Mr. Morris is in part correct in his conclusion, when he says, in the *Appendix* alluded to, "for if these sluiceways or chutes are so arranged as to admit the safe passage of those burdensome but frail boxes of pine lumber, called 'coal arks,' which draw six feet water, it is clear that they must also answer for the transit of the stronger steamboat, which never draws so much"—true, when there is six feet clear depth on the sluiceway, it is expected that steamers may and will pass up and down without using the locks.

Mr. Morris proceeds—"In this shape, this plan, in fact, becomes the plan of Mr. Haupt, that of 'low dams and chutes.'" Whereas, when understood, the two things are quite different; Mr. Haupt's plan being designed for low water, with an actual opening through the dam, whilst the sluiceway or chute referred to by the writer, is a mere prolongation or flattening of a portion of the dam up and down stream, not calculated for low water use, the pools being always kept full.

With the slackwater completed between Pittsburgh and the Mississippi River, the entire business would be revolutionized within a few years, from choice on the part of the lumbermen and coal dealers. A large proportion of the lumber, and all the coal, would be conveyed in barges to the Lower Ohio, and thence up and down the Mississippi. Still it is no part of the plan to force trade of any kind. Coal boats, even now, drawing six feet water, cannot with prudence be started from Pittsburgh with less than 10 feet water in the channels, and with such a body of water, the chutes can be so arranged as to permit their safe passage.

Although dams not exceeding 8 feet height from pool to pool may be thus arranged, the writer is at a loss to know how such an arrangement can be made in dams fifty to one hundred feet high, as proposed by Mr. Ellet and Mr. Morris for the Allegheny River above Pittsburgh, notwithstanding Mr. Morris has intimated that "it is not difficult." Another argument of Mr. Morris, fortunately applies below as well as above Pittsburgh. He says, "that the lumber will only be passed down at stated periods, forms no objection: since with unobstructed streams, it is only *occasionally*, and at very *uncertain* times, that it can now be run at all."

To the mind of the writer it appears clear, that whatever objection there may be—on account of the descending navigation interests—to the improvement of the Ohio River by means of low dams, will be much more forcible in connexion with the high dams suggested as part of Mr. Ellet's plan, notwithstanding the latter are to be placed above Pittsburgh.

5. *The fifth objection* is, "the cost, cost of maintenance and tolls." These may naturally be classed under one head. The leading idea intended to be disseminated under this fifth objection, is, that on Mr. Ellet's reservoir plan the first cost will be less, the maintenance less, and the tolls nothing.

Having advocated the improvement of the Ohio River as a national work, and presuming that it may be thus effected directly or indirectly, the writer cannot perceive the point of difference so far as *tolls* are concerned. If the government expends $20,000,000, in constructing, repairing, and managing artificial reservoirs for making an artificial river, and is not to charge citizens using the same any tolls therefor, why should the same government expending ten or twelve millions in constructing a slackwater improvement charge any tolls for the use thereof? Is there any *principle* in one case not involved in the other? Whether it will cost more to maintain and manage the slackwater than it will to maintain and manage reservoirs, is a point yet to be determined. But if it should be proved likely to cost more, that could only affect the *rate* of tolls, not the principle of charging tolls.

The first cost of a slackwater has been variously estimated by its friends at six to twelve millions of dollars; by its opponents at ten to twenty-five millions. Some have set down ten millions as necessary for "auxiliary reservoirs," for slackwater purposes. But this last item must be regarded as very extravagant in view of the claim, that it would cost less than two millions to furnish water enough to keep up the flow on the entire natural river to a five feet stage, all the year round, as estimated by Mr. Ellet, and approved by Mr. Morris. Surely, it ought to cost much *less* than two millions for any possible imaginary need for slackwater use! Why a five feet flow, according to the calculations, affords 864,000,000 cubic feet in 24 hours. Now a lockfull, of the largest size, as already shown, is but 182,000 cubic feet, and allowing a lockage every 2½ minutes, or 24 lockages per hour, or 576 per day, it would be but 104,832,000; leaving 759,168,000 cubic feet, or a flow equal to more than 4 feet depth over the Wheeling bar, for the evaporation and to leak through the dam—a most extravagant assumption, certainly.

Does not this show to the candid inquirer, that the expression "ten millions of dollars for auxiliary reservoirs," is made entirely at random? This incongruity is glanced at without for a moment admitting that there can ever be any necessity for reservoirs of any kind for the lock and dam navigation. In continuation of the thought in connexion with the lockages just assumed, look at the aggregate result it would give! Allowing an average of but 500 tons to each lockage, it would be 288,000 tons per day, and for 340 days per annum, *one hundred and twenty-nine millions of tons;* an amount perhaps *ten times* greater than may be expected for some years to come.

Under the head of this fifth objection, relating to the "cost, maintenance, and tolls," it may be proper to enter somewhat into detail. Is it very difficult to make a reliable estimate of what the slackwater improvement ought to cost? As an engineer, the writer is constrained to answer that it is one of the simplest problems that could be presented to those members of the profession who have had experience in constructing river locks and dams. Except as to the damages that may be caused by actual overflow from backwater, the items are such as admit of an easy solution. Mr. Morris, including ten millions added for auxiliary reservoirs, adopting Mr. Ellet's random estimate of twenty-five millions, assumes thirty-five millions as the probable cost, and then proceeds to say, "even this great sum will not appear large to those civil engineers who reflect that such works as would be necessary to control this mighty river—constructed upon the dangerous gravel bottom which forms its usual bed—have never yet been executed in any country."

To warrant this there must have been something contemplated which has never entered into the calculations of the writer. He has only thought of carrying out very much such plans as he has carried out successfully before. The Monongahela River, in its natural state, as surveyed in 1838, was too nearly like the Ohio River in its present condition, to render such language applicable to one without being almost equally applicable to the other. The average fall in the Monongahela

below Brownsville, was seven inches per mile; the fall in the Ohio between Pittsburgh and Wheeling, is about ten inches per mile, and between Wheeling and Cincinnati, 6¾ inches per mile. There is not difference enough in the natural declivity to base any strong argument upon; and on an average, what difference there is, is in favor of the Ohio River. Secondly, the bed of the Ohio is as much like that of the Monongahela in its characteristics, as any similar distance on the Ohio is like any other part of itself. On each river rock bottoms sometimes occur, but generally the foundations will be gravel, not *sand* in any case—the gravel being of precisely similar general character. Thirdly, the very high floods on the Monongahela had risen to about the same elevation as those on the Upper Ohio—over 30 feet above low water. True, at Wheeling the Ohio has risen 45 feet, and at Cincinnati 63 feet above low water. It is yet to be decided whether this will operate for or against the system of locks and dams, as proposed. If our proposition was, as figuratively expressed, to "bridle" the river, the fact that the Ohio River rises higher than the Monongahela, might have an important bearing; but as no such thing was attempted on the Monongahela, it is not proposed on the Ohio. On the contrary, instead of "bridling," every arrangement consistent with the convenient management of the locks was made, to afford the floods a clear sweep. The lock-walls were designed to be only of such height that when the navigation over the dams should be safe, they would be submerged, and the locks for the time being would not be used. What essential difference will it make, whether they be submerged with 20, or 10, or 5 feet depth of water? Fourthly, the dams on the Monongahela below Brownsville, are 15 feet high above the bed of the river, and above Brownsville 19 feet. Those on the Ohio are not to exceed 14 feet. The longest dam on the Monongahela is 1300 feet. After deducting the space occupied by the double locks, it is thought that those on the Ohio will not average over one-fifth more or 1560 feet. Fifthly, the large locks on the Monongahela are 250 by 55 feet; it is proposed that the locks on the Ohio shall not exceed 350 by 65 feet. The difference is mainly a question of cost, involving no peculiar engineering problem. Locks as large as the largest yet proposed for the Ohio, have been built on the ship canal of Sault St. Marie, below Lake Superior.

What then is it that is to be encountered on the Ohio that has not already been met and overcome by American engineers? The principal difference between the regimen of the Monongahela and Ohio Rivers, arises from the greater height of the floods on the middle and lower portions of the Ohio. The locks will be more frequently and longer submerged. On the other hand, the dams being one foot less in height, the river over them will become boatable a little sooner than on the Monongahela, and will continue so for longer periods. There are some advantages as well as disadvantages in having the locks submerged. So far as the dams alone are concerned, the lower they are the better; but in connexion with locks we must take care not to increase the number unnecessarily. As low water periods cover about one-half the boating season, it will probably be found that the height already suggested, 8 feet from pool to pool, is convenient and proper.

We will then assume that we have to estimate the cost of a double lock 350 by 65 feet chamber, with 8 feet lift, and a dam 14 feet high and 1560 feet long. We assume substantial rubble stone work for the lock walls and abutments, and timber cribs filled with stone for the dam.

Estimated cost of one Dam and two Locks, including chute in Dam.

Foundation excavations, 4000 cubic yards at 75 cents,	$ 3000·00
" " 5000 " 25 "	1250·00
Abutment masonry, 1500 " $6,	9000·00
Crib timber, 7500 feet lineal, at 15 cents,	11,250·00
Upper covering, 170,000 feet B. M., at $20,	3100 00
Lower " 40,000 feet lineal, at 15 cents,	6000·00
Sheet-piling, 50,000 feet B. M., at $20,	1000·00
Iron, bolts, spikes, &c., 75,000 lbs. at 10 cents,	7500·00
Stone filling, 24,000 cubic yards, at 80 cents,	19,200·00
Excavation of foundations, 7000 cubic yards, at 75 cents,	5250 00
" " 4000 " 25 "	1000·00
Feet lineal of timber, 3600 " 15 "	5400·00
" B. M. plank, 264,000, at $20,	5280·00
" " sheet-piling, 15,000, at $20,	300·00
Pounds of iron, bolts, &c., 22,000, at 10 cents,	2200·00
Cubic yards of lock-walls and head wall, 10,200, at $7,	71,400·00
Gates and fixtures,	20,000·00
Lock house,	1000·00
Chute in dam,	12,000·00
	$185,430·00
Add for contingencies and engineering, 10 per cent.,	18,543,00
	$203,973·00

Allowing that the entire length of the Ohio River should be embraced, requiring 50 dams, it would make a total of $10,198,650.

In round numbers, ten millions of dollars, not including damages that might be caused by overflow ; which, however, is not likely to be a very heavy item. We may reason, *a priori*, from the fact that the Ohio River is *at all times* subject to floods rising 40, 50, and even 60 feet above the ordinary stage, that there cannot be a very great amount of property exposed to injury from an overflow which averages but ten feet, and no where exceeds fourteen. Experience on the Monongahela River confirms this view. The damages alluded to will not probably constitute a large or controlling item. It is true that a careful examination will be required to determine accurately what it may amount to, but we may apply some judgment respecting it in advance. In the opinion of the writer, a total cost of eleven millions of dollars will cover the entire improvement including damages.

Cost of Maintenance per annum.

1 general superintendent,	$ 5000·00
3 assistants, at $1500,	4500·00
9 foremen, " 600,	5400·00
90 hands, " 400,	36,000·00
100 lock-tenders, 300,	30,000·00
3 steam tows, interest rent,	15,000·00
6 flats, " "	1200 00
Materials,	10,000·00
Total,	$ 107,100·00

Being about one per cent. on the original cost.

And even if the government should provide for 6 per cent. per annum in addition on the gross cost, and charge all to the improvement, the total per anuum would be but $767,100.

What rates of tolls would it be necessary on this assumption to charge to cover all? If we take the aggregate *value of the business* to be accommodated on a complete navigation at $400,000,000, it would be less than two-tenths of one per cent.—less than two mills on the dollar of value!

And what would be the saving to merchants, manufacturers, farmers, and all consumers? It would be many millions of dollars in insurance. In absolute saving from destruction of thousands not insured, including an immense amount of coal now annually lost. In increase of profits from increase of business with less invested capital. In saving of interest on great quantities of produce and manufactures which now lie worse than idle for months. In the certain and general increase of all descriptions of business along the Ohio River valley which must follow the completion of such a reliable navigation.

The annual saving in insurance alone, will go far towards covering the entire aggregate.

Next, in regard to the coal trade: it has been stated by intelligent gentlemen familiar with the coal shipping business of Pittsburgh, that the annual loss in various ways, is about 20 per cent. of all that starts to go down the river. On the limited amount of one million tons, this would show an actual loss of 200,000 tons, which at an average of $4 per ton for the value down the river, would be $800·000; which is more than the whole toll required to cover interest on cost and maintenance of the improvement. But with such an improved river we shall have *three millions* of tons almost immediately upon its opening—thus presenting an annual saving fairly to be considered of $2,400,000 on the single article of coal. Nor is this all. There is now a heavy expense attending the coal business, which would be entirely cut off, namely, watching and bailing coal arks while waiting days, weeks, months, sometimes almost half a year, for a rise in the Ohio to take them out. The great amount of dead capital which must now be invested in consequence of this mode of doing the business is a serious clog upon its progress.

It is well known that some of the finest coal fields in the world are to be found between Wheeling and Pittsburgh, and along the tributaries above, and that the cities below on the Ohio and Mississippi consume large quantities from that region, and would consume *much more* could the supply be made certain and regular, with a reasonable regular price instead of a fluctuating scale varying from 12 to 40 cents per bushel. There has not yet been discovered along the Lower Ohio or Mississippi Rivers, any coal comparable to the Pittsburgh seam for gas purposes. Applying the calculation to only one and a half millions of tons of coal per annum, which is equal to 42 millions of bushels, a charge of one cent on the thousand miles of the Ohio River would be $410,000—a charge that would be saved to the coal interests several times over any year. And this is but one branch of the great aggregate trade upon

which this merely nominal tax would be distributed! It is not too much to assume that the entire cost of carriage of the coal on the improved navigation will be less than the present annual aggregate losses and extra charges. But this is not the place to enter into further detail in relation to this important question. In due time its investigation will doubtless be fully made.

The receipts on the 55 miles of Monongahela navigation in 1852, were $62·666, or an average of about $1340 per mile. The same business at similar low rates per mile on 1000 miles of the Ohio improvement would be $1,340,000. It cannot be questioned that the general business on the Ohio will be very much greater, and the tolls may thus be kept down to still lower rates.

Mr. Ellet in treating this branch of the subject, emphatically remarks: "It is scarcely to be doubted that the maintenance of a depth of 5 feet in the Ohio alone, at all seasons, would save the country from an annual tax upon its present business [7 years ago,] of five millions of dollars." It is evident that the rates of toll on the Ohio slackwater can be made lower even than they are on the Monongahela; and they are less on that improvement than they are on any other public work in the United States. The average on classed freight is about 5 mills per ton per mile, and on coal about 2 mills.

From the foregoing data we think it is shown, that the original cost of the slackwater, cost of maintenance, and the rates of toll that may be deemed necessary, do not constitute startling objections to the slackwater as a system. No radical improvement of so large a stream can be accomplished without considerable cost; the real question is, can it be effected in any cheaper or better manner?

6. *The sixth objection is*, "that the pools will fill up with sediment." This has been answered more than once, but at no time more beautifully than in the communication of Josiah Copley, Esq., to the Pittsburgh Board of Trade, dated January 15th, 1856. He says, "apprehension has been felt and expressed by some persons, that in time these pools will fill up more or less with sand and mud, and the channel be rendered too shoal for navigation; but these fears are groundless." * * * "On the Ohio, the inclined plane will be restored whenever the water raises to a height above 16 feet above the ordinary low water line; and that being the case, the velocity of the current will be the same as if no dams existed; for the water will be urged onward, in obedience to the law of gravity, with all the speed due to the natural fall of the river, just as it now is. This being so, its power to sweep its pools will be unimpaired, and consequently the debris cannot be deposited any more than it is now. In their natural condition, the Allegheny and Ohio are but a long series of alternate *dams* and pools—the ripples, as we call them, being nothing else than natural dams. The intervening pools or "eddies," as they are generally though improperly termed, are frequently thirty feet deep at the lowest water; yet the floods sweep them out, and they indicate no appearance of filling up.

"It is only in streams so small that no floods can ever restore the inclined planes broken by dams that we find pools filled up with debris. They never rise sufficiently high to restore the original velocity of the

water in the portions of their channels occupied by these artificial pools; the consequence is, that whatever sand and mud are carried down from above, are deposited in this slackwater and remain there. In time the channel becomes so contracted, both in breadth and depth, that the stream in times of freshets, acquires its original velocity. After that no more sediment is permanently deposited.

"The Monongahela pools furnish a confirmation of the truth of the position here taken." And, it may be added, so do the pools of the lower Lehigh, the Juniata, the Kiskiminetas, the Beaver, &c. This objection appears to have no practical foundation. If it were applicable at all to any dams yet proposed on the Ohio or Allegheny, it might have some force against those very high dams designed by Mr. Ellet to form a part of his artificial reservoir system, where the height of the dam would exceed the greatest natural rise of the stream, not permitting the river at any stage to be restored to its natural inclined plane, and where for much of the time these immense pools would be comparatively still. But even in this case the writer regards the objection as futile. Almost universal experience teaches, that no difficulty from this cause could arise on the Ohio River with pools of only eight feet lift, and floods of more than 30 feet height.

(To be Continued.)

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*On the Disturbances of Suspension Bridges, and the Modes of Counteracting them.** By Messrs. A. S. Lukin and Charles E. Conder.

This Paper brought under consideration the various kinds of suspension bridges, and examined their greater or less liability to undulations of the roadway, and other disturbances, occasioned by a traversing load, or other causes.

These disturbances were attributed chiefly to the flexibility of the chains, and were enumerated as follows:—

1. Undulations caused by traversing loads.
2. Reaction on the roadway of the chains when set in agitation.
3. Transverse swing.
4. Distortions caused by the gravitating tendency of the chains.
5. The effect of unequal loading in bridges of multiple spans.

The first class of disturbances might be reduced by increasing the mass of the chains. The objection to this was that not only would such an expedient prove wasteful of material, but the greater the weight of the chains the greater the danger of their destroying the platform, if once set in agitation. Again, the roadway might be supported by a rigid girder, strong enough to withstand any distortion of the chains. Such a girder would, however, be nearly strong enough to carry the load independently of the chains, which would become dangerous auxiliaries to an inflexible platform.

The Niagara Suspension Bridge was adverted to, as having its liability to undulate much reduced, not only by connecting the upper and lower platforms with lattice trussing, but also by employing strong upper and under bracing rods.

* From the Lond. Artizan, July, 1857.

It was contended, that while a certain degree of stiffness in the platform would be advantageous, as equalizing the distribution of the load on the chains, the main point for inquiry must be the arrangement of chains and rods best calculated to abate the liability to disturbance.

With this view six modes of arrangement were described and illustrated, viz:—

1. The ordinary suspension bridge.
2. The mode of suspension by a double set of crossed chains (Russel's).
3. The single rod direct suspension.
4. The chain with slanting rods (Dredge's).
5. The double rod direct suspension.
6. A new mode, distinguished as the convergent suspension, of which two varieties were exhibited and explained, by means of diagrams and models.

1. It was pointed out, that while the ordinary form of suspension bridges effected a marked economy of material, its great flexibility and liability to undulate and swing, operated against its employment for railway traffic.

2. The mode of suspension by crossed chains (as in Mr. Russell's bridge), while tending in some degree to reduce these disadvantages, required an enormous increase of material, together with a double height of tower.

3. It was stated that the single rod direct suspension, while perfect in theory, as regarded freedom from undulation, was defective, owing to the length required for the rods, the sharp angles at which they met the roadway, and their consequent liability to stretch and "sag."

4. The introduction of a chain to support the slanting rods (as in Mr. Dredge's bridge) diminished these evils and shortened the rods, at the same time that it secured a more equable distribution of the tensions. But this arrangement, in common with the preceding mode of direct suspension, imposed powerful horizontal strains on the roadway; and the excessive strength thus demanded in the platform, militated against economy, if it did not even impair the safety of the whole structure.

5. The double rod direct suspension entirely relieved the platform from any horizontal strain. But the great length and angle of its extreme rods entailed and increased all the other evils to which the single rod direct method was exposed.

6. The convergent mode of suspension was devised to avoid, as far as practicable, the several defects which had been pointed out in the five arrangements abovementioned. From a double set of chains (each extending from the top of one tower to the platform level at the opposite extremity), a double set of rods were suspended, slanting in opposite directions, so that a pair of rods converged to every point by which the platform was suspended. There was thus an entire absence of horizontal strain on the roadway, which might, therefore, be made of extreme lightness, while the advantages of direct suspension would be to a great extent secured, the undulations of the roadway and the tendency to lateral swing being reduced to a minimum; and the reaction of the

chains on the platform would be much diminished by the radiating play of the rods. It was shown, by means of tables, that the convergent principle admitted considerable economy of material. Two designs were exhibited, the second of which, although theoretically inferior to the first, effected a great saving in the weight of the chains, by allowing a sharper curvature. At the same time it was submitted, as a matter worthy of inquiry, whether an application of the convergent method might not be arrived at still better suited for large spans.

A mode was suggested of connecting each pair of rods with the platform, by means of a self-adjusting lever, the play of which, by equalizing the horizontal strains, would tend to diminish the derangements caused by an unequally distributed load.

It was pointed out that the gravitating tendency of the chains would cease to operate, as a source of disturbance, if their sectional weight were so adjusted (by ballasting or other means,) as to cause them to hang naturally in the curves due to the conditions of suspension.

The effect of unequal loading in bridges of multiple spans was then adverted to, as giving rise to danger, through the unequal tensions induced in the chains on opposite sides of a tower. A table was given, showing that the employment of convergent rods reduced this danger to some extent. Inverted chains below the platform were also advocated in bridges of multiple spans designed for railway traffic.

The mathematical reasoning and formulæ upon which the foregoing conclusions were based, were not considered suitable for reading aloud, they were therefore given separately in an appendix.—*Proceed. Inst. Civ. Eng.*

For the Journal of the Franklin Institute.

On Joints for Railroad Bars. By A. C. Jones, Engineer.

In the recent discussion on joints for railroad bars, I believe that there was no mention made of the injury to the joints, resulting from the common method of making a curve to consist of a series of short chords by each length of rail being laid straight, or if sprung to a curve, its stiffness aided by the running of the trains, soon brings it to a straight line; from a personal inspection of tracks, almost continuous from Massachusetts to Alabama, I found that scarcely any attention has been paid to this point, and yet at a glance of the diagram, it will be seen that there is a side thrust from the flanch of each wheel, aiding the vertical pressure to loosen the joint and chair.

Persons having been on the platform of the old four wheel locomotives, when running, may remember the unpleasant side twitch from this cause; the flanches hugging the straight rail by the centrifugal force, runs its

length to the end of the next, there to be changed from its tangential course, and so on the next length until the curve is run. This is not now so perceptible with the *truck*, but still it is an element of destruction, and is one cause of trains leaving the track.

The proper mode is to curve the bars before laying them. The expense of curving the bars is not great, for during my connexion with the New York and Erie Railroad, as many as five hundred (20 feet) heavy bars were curved each working day in midwinter, by two laborers operating on a curving bench, the rail being brought to it by assistants.*

All persons traveling on railroads where chairs are in use, have noticed the disagreeable rattling consequent to the play of the bars in the chairs. As early as 1834, it attracted my attention, and I suggested a plan for obviating it, but it was not until 1840, that I had an opportunity of proving it myself. I took a few chairs (Stephenson's iron keys), and recessed them about $\frac{1}{4}$-inch, leaving a chipping piece at each end, when the chairs were in place without the keys, the recesses were filled with metallic lead, (hard from having been melted many times,) and although this was a part of the track which was used both ways by a large traffic, yet during the five months it was under my notice, there was no "spewing out" of the lead, and the noise was slight compared with the keyed chairs.

Many of the wrought iron chairs exhibited at the meeting, having been fitted nicely to the individual bar, left nothing to be desired for fit, but in providing for a long line of road it would be different. Now, instead of this attempt at perfection which will enhance the cost of the chairs, they are "set in" at the ends and middle of long chairs, and the spaces between the bar and chair filled in with fusible metal; you have as perfect a fit as it is possible to make and at a small cost. There are many alloys melting at a low temperature, which when set, are nearly as hard and tough as wrought iron. When the bars are wished to be held endwise by the chairs, a piece of iron inserted in the holes will be kept by the alloy in place.†

Allusion having been made to the difference between the wear and tear of the rails on an unyielding superstructure and one that is springy, it may not be out of place to record the following. The Portsmouth and Roanoke Railroad, (built by Major Walter Gwynn,) runs over a portion of the Dismal Swamp, which consists of a turf-like substance ten or twelve feet thick, over-lying a semi-fluid material composed of fine sand, mud, decayed vegetable matter, and water. The weight of a person jumping up and down on its surface will produce a wave, which will cause another person many yards from the first also to rise and fall. This was the condition of the foundation for the road way, and the superstructure was made of split-rails (similar to the farm-fence,) laid crosswise two feet in thickness, and about two feet of earth on top, and then the sills or ties as usual; on each side ditches were made, which always

* Full particulars may be obtained by referring to my article on this subject published in this *Journal*, Vol. ii. 3d Series, p. 23, 1841.

† The proper place to secure the bar to the road-bed for expansion or end thrust, is at its middle either by a chair or notch and spike.

remained full of the dark-colored water of the swamp. This piece of road gave great trouble to keep in order for eight or ten months, until the interstices of the split rails had become filled and all consolidated, and afterwards this was the smoothest and best part of the track.

On another part of this road, in 1835, before the truck cars were in use, I tried an experiment on a straight level part, by painting the surface of the flat bars, and then had the train run over them at a speed of 40 miles per hour; the paint midway between the ties was not touched, the wheels actually jumping from one tie nearly to the next one, and this was the case on both sides of the track as far as painted.

Believing that the chair and rail should be of the same metal, I propose a "clamp chair,"* (see sketches,) which is easily made, and involves no extra labor to be done to the ends of the bars; it has vertical and side stiffness, combining most of the good qualities of the "side fish," under plate, and T form, without requiring the rail bar to be drilled or punched, nor rivets or bolts to secure it to the rail; it may be long enough to suit a single cross-tie, figs. 1 and 2, or for two ties with the joint of bars between fig. 3. The chair by either method of fastening will be held firmly to the ties and bars, and yet it admits of being quickly removed when required.

Fig. 1.

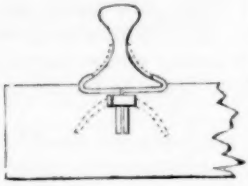


Fig. 2.

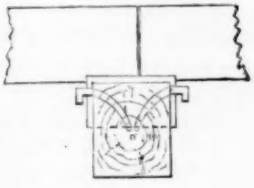
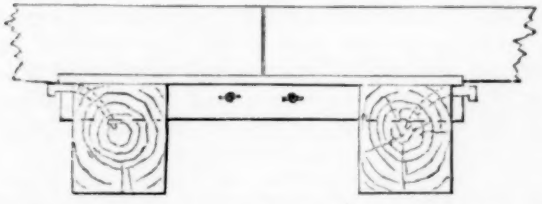


Fig. 3.



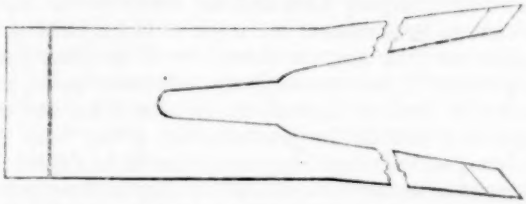
Angle iron of a suitable length is bent on one edge so as to hook over the bottom web or base of the rail bar, and at each end a small piece is punched out, so that when two of these plates are placed with their straight flanches together, these square notches receive the head of a wedge-shaped staple, which clamps the two side plates on the base of the bar and at the same time fastens all to the cross-tie.

The part of the chair hooking over the bar could be extended up the stem, as shown by the dotted lines, fig. 1, but this would enhance the cost of making and fitting without commensurate benefit, as $\frac{3}{4}$ths to one inch

* This and its fastenings, will be referred to the Committee on Science and the Arts, to be reported on.

hook is ample for the purpose. The staple (fig. 4,) is made of wrought iron, the head suiting the notches in the chair; it has a hook on one side to facilitate its withdrawal from the tie after it has been driven in it, the "tines" are about 4 inches in length, and only differ from a square spike by the end being bevelled *diagonally*, like an engraver's tool; the only part requiring accuracy is the V form of the inside; this should be closer at the narrow part than the two thicknesses of the vertical flanches of the chair.

Fig. 4.



The wooden cross-tie having been prepared for the reception of the chair, the two plates are slipped along the rail until in position on the tie, and the staples (previously slightly bent in the direction of the point,) are driven into the sides of the tie, and the diamond-shaped points will cause the tines to pass in curves downwards and endwise towards the heart of the tie, spreading more and more until home; the stiff jaw of the head grasps the two parts of the chair in the notch, drawing them close together, and the hooked edges on the wedge-shaped base of the rail secures it to the chair. All are held firmly to the tie by the head of the staples in the notches of the chair.

The two parts of the chair when fitted to the bar should have a clearance between to suit variations in bars, to allow of compression and the springing of the parts. If thought proper, a thin slip of wood could be placed between the two flanches below the staples.

It will be readily seen that the inside surfaces of the staples exert a great force to draw the two parts of the chair together, that the staple is prevented receding by the clinched form of its tines, and that the running of the trains cannot draw out the staple, as any force applied to the rail only acts on the *side* of the head in the notch of the chairs.

Fig. 5.

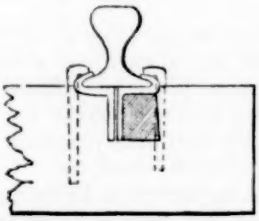
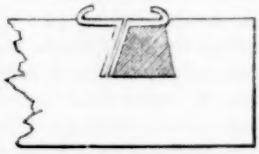


Fig. 6.



To withdraw the staples from the tie, a wedge-shaped tool is driven between the hooked head of the staple and the ends of the chair, and the staple drawn out; the plates forming the chair being pushed endwise, the two ends of the rail bars are set free.

In long chairs with the rail joint between the ties, two keyed bolts (fig. 3,) may be used along with the staples at the ends.

Another mode (fig. 5,) of securing the chair to the bars and ties, is to take the lengths of angle iron, and instead of notching at the ends, make two notches in the hooked part; the jogs in the ties are made to suit a key made of hard wood passing outside of the vertical flanches of the chair. After this key is driven tightly in both cross-ties, the chair is held down by the usual hook-headed spikes in the notches, and the key prevented working out.

Staples and spikes may be dispensed with, by making the straight web of the chairs to hook under, (fig. 6,) forming a half "dove-tail," and the key driven alongside as before; the key could be prevented working out by a single nail driven in its side.

AMERICAN PATENTS.

List of American Patents which issued from June 30th, to July 28th, 1857, (inclusive,) with Exemplifications.

JUNE 30.

246. For an *Improvement in Fountain Lamps;* Henry Wright Adams, City of New York.

Claim.—"Providing the burner cup with an internal cylinder or lining, to leave an open bottomed but close topped passage around the burner in communication with the tube or passage coming from the fountain or reservoir, said internal cylinder or lining being provided with an opening opposite the tube or passage."

247. For an *Improved Smelting Furnace;* Charles C. Alger, Newburgh, New York.

Claim.—"An improved furnace, that is, with its hearth or crucible and boshes of an elliptical or elongated form, in combination with the two mouths (one at each end for working and tapping), and two or more tuyeres at each side, so arranged as to introduce the blast in the direction of the breadth."

248. For an *Improved Machine for Making Bolts and Rivets;* Joel R. Bassett, Cincinnati, Ohio.

Claim.—"1st, The clamps constructed and arranged on the periphery of a rotating stock, in such manner as to be readily accessible for inspection and replacement, in combination with the friction roller for the clamping and releasing of the bolt or rivet. 2d, In combination with the above, the yielding rest and divided cutter, by means of which the rotation of the clamp stock severs the blank, the end of the rod being contracted during the act of separation, and afterwards released by the retraction of the rest and cutter. 3d, The arrangement of heading dies and adjustable stationary cam, in combination with the clamps and the perpendicular face of the plate."

249. For an *Improved Machine for Riveting Boilers;* Silvester Bennett, New Orleans, Louisiana.

Claim.—"The employment, in combination with the riveting punch or plunger, of a hollow 'set' fitted to slide upon the exterior of the same, and operated to close or set the metal around the rivet before the operation of the punch or plunger commences, and hold the same closed during such operation."

250. For an *Improvement in Iron Pavements for Streets;* George W. Bishop, Brooklyn, New York.

"The object of my invention is to make a pavement for streets of blocks of iron, so formed on their upper surface as to effectually prevent horses from slipping, and permit

water with accumulating dirt to run off to the side gutters, and at the same time of securing rails thereto for a railroad."

Claim.—"Making cast iron paving blocks with a series of transverse draining grooves, which when completed and laid, will form grooves running from the middle of the street towards the side gutters or sewers. Also, forming the surface of iron paving blocks with a series of inclined planes and shoulders, to prevent horses from slipping, while at the same time carriages will roll over the surface without serious impediment or concussions. Also, the said series of inclined planes and shoulders, in combination with the lateral grooves for draining, but which also answers the purpose of preventing horses from slipping. Also, the manner of uniting the iron blocks in laying a pavement by the alternating over and under lapping of the series of blocks, whereby the blocks are enabled to sustain one another, and thereby more effectually maintain the required grade."

251. For an *Improvement in Machines for Making Paper;* Edward B. Bingham, Brooklyn, New York.

Claim.—"The employment or use of the endless aprons, one or more, placed within the pulp vat adjoining the cylinder."

252. For an *Improved Blast Blower;* John Brough, Aurora, Illinois.

Claim.—"The wind or blast wheel, constructed of the circular plates, having openings made through them, and provided with hoods, the plates having a bucket or piston, one or more, secured between them, when the wheel thus constructed is fitted within the fan box constructed in the form of a scroll."

253. For an *Improved Machine for Making Horse Shoes;* Henry Burden, Troy, New York.

Claim.—"1st, The feeding apparatus, and in connexion therewith the mode of cutting off the rod; also, the self-acting device for stopping the feeders, and the mode of renewing their action at the proper time. 2d, The mode of bending the rod and placing it in its proper position between the swaging dies. 3d, The flanch on the upper swaging dies. 4th, The combination of the revolving, creasing, and punching die, with the revolving swaging dies, by which both operations are successively and automatically performed. 5th, The devices for taking the shoe from the upper, and confining it to the lower dies, and finally taking it from the lower dies and conducting it to the flattener. 6th, The means for flatening the shoe. 7th, The combination and arrangement of machinery by which the several processes are performed successively by one machine, and without aid from attendants. Also, those devices, or their equivalents, which shall effect the same."

254. For an *Improved Portable Steam Radiator for Heating Apartments;* I. H. Chester, Cincinnati, Ohio.

Claim.—"The portable radiator constructed with plain inner surfaces, the deflector, boiler, and tube."

255. For an *Improvement in Distributing Apparatus of Flouring Mills;* Alfred T. Clark, Lancaster, Pennsylvania.

Claim.—"The double series of spouts and valves, arranged and connected with the bolting chamber. Also, the arrangement of the conveyer, in combination with the double series of valves and spouts."

256. For an *Improved Whiffle Tree Hook;* Anthony Cooley, Paw Paw, Michigan.

Claim.—"Providing the outer extremity of the hook socket with an open slot and spring seat, and fitting the feather spring and the shank of the snap in the same. Also, furnishing internally each of the cheek-pieces of the open slot of the hook socket, with a scroll slot, and the snap with two short journals, and fitting these journals in said slots, and holding them in place by means of the feather spring."

257. For an *Improved Earth Excavator;* Curtius Colby, Wilson, New York.

Claim.—"1st, The use of the levers with their combination. 2d, Suspending the arms to the frame at a point above the level of the top of the excavator, thus securing the elevation of the hind as well as the fore part at the same time. 3d, Causing the return of the bottom of the excavator to its proper position for reloading by means of the strap and roller."

258. For an *Improvement in Uterine Supporters;* W. E. Cooke, Philadelphia, Pa.

"This invention is to relieve and permanently cure 'prolapsus uteri,' and the other diseases consequent thereto—and the nature of the invention relates to the manner in which the supporter and truss is made self-adjusting or self-yielding to the body of the wearer in all material parts."

Claim.—"The manner of uniting the bars to each other, and to their pads respectively, through the intervention of the sides or hip bars, so that the truss and supporter may not only be adjustable, but also self-adjusting to the person or body of the wearer. Also, in combination with the front pad, an adjustable pessary."

259. For an *Improvement in Gas Regulators;* John H. Cooper, Philadelphia, Penna.

"My invention relates to improvements in that class of gas regulators in which a valve, spring, and inverted cup are used, and my improvement consists in so connecting the inverted cup and valve to an arm hinged to the interior of the instrument, that its sensitiveness is increased by avoiding the objectionable friction common to ordinary gas regulators."

Claim.—"The combination of the inverted cup, arm, and valve, when both valve and cup are attached directly and permanently to an arm hinged to the interior of the casing."

260. For an *Improved Horse Shoe;* Wm. Cooper, Brooklyn, New York.

Claim.—"The use of a metallic plate horse shoe covering the base of the hoof, having a suitable stopper fitting into a screwed opening in the same, or an equivalent therefor."

261. For an *Improvement in Gas Burners;* Asa D. Gates, Binghampton, N. Y.

Claim.—"Attaching to the top of, or slipping over the usual burner the conical or cylindrical supplemental chamber burner."

262. For an *Improved Apparatus for Separating Oily Particles held in suspension by Steam;* Robert Hale, Roxbury, Massachusetts.

Claim.—"The apparatus for separating oil from steam."

263. For an *Improvement in Harvesters;* Henry D. Hammond, Batavia, New York.

"The invention consists in a peculiar combination of devices for the simultaneous turning up of the teeth of the harvesters, and the elevation of the side of the machine towards the standing grain."

Claim.—"The shaft with arms relatively attached thereto, in combination with the swinging flanched supporting bar, and the journaled cutter and finger bar, connected with arms, when said parts are arranged for joint operation."

264. For *Improved Adjustable Fender Posts for Saw Mills,* Henry Harpold, Racine, Ohio.

"The invention consists in constructing the fender posts in saw-mills in such a manner that the slides may be so varied as to give the saw any desired pitch, and also that when the saw has worn, hollowing in the centre, the frame may be so adjusted as to accommodate itself to the shape of the saw; also in the arrangement of the jaws."

Claim.—"1st, The fender-posts arranged in two parts and adjustable, secured together by hook bolts, and working on a pivot on the fender beams. 2d, The jaws and blocks attached to the saw sash, and working on a swivel arranged with the adjustable fender posts, for the purpose of giving the saw pitch and making it follow a desired curve."

265. For an *Improvement in Harvesting Machines;* John K. Harris, Allensville, Indiana.

Claim.—"Imparting to the cuttter bar of harvesting machines, a uniform reciprocating motion by means of the duplex drive wheel, when used in combination with the rocking pinion, said wheel and pinion being geared by means of alternate and oblique sets of cogs."

266. For an *Improvement in Electric Telegraphs;* Harrison G. Dyar, City of New York; patented in England February 3, 1851.

Claim.—"Constructing and operating signalizing telegraphic apparatus in such manner that electric pulsations representing signals resulting from the actions of two or more operators at work at the same time, are imparted alternately and successively to a

single main conductor or wire of communication, and received therefrom, and distributed in the same alternating succession, whereby a single main conductor may be made the instrument by which two or more operators can be simultaneously employed in sending different messages either in the same or in opposite directions. Also, transmitting different electric signals, resulting from the actions of two or more operators, working at the same time, at the same or opposite ends of a single main conductor, by means of a single main conductor, combined with two or more sets of corresponding signal sending and signal receiving conductors, which represent the different signals in use, and are appropriated to different operators by means of intermediate circuit making and circuit breaking apparatus, which are moved in harmony at the signal sending and signal receiving stations, in such manner as to present themselves successively in all the positions required to permit currents of electricity to be passed alternately through the corresponding members of the signal sending and signal receiving conductors, whereby the apparatus at each station can at the same time be employed in transmitting and receiving signals representing messages. Also, transmitting electric pulsations to a main conductor, and distributing them from the same main conductor by two sets of circuit making and circuit breaking apparatus, which are moved in harmony with each other, but are moved by the mechanism independently of the other portions of the telegraphic apparatus, in such manner that the harmonious movement of the circuit making and circuit breaking apparatus at either end of the main conductor is not impeded or controlled by the irregular movement of other parts of the telegraphic apparatus. Also, sending and receiving signals, as above stated, by apparatus, so arranged and combined with the main conductor that in operating the impulse that closes or opens the circuit shall last but a moment, while the contact maintained at the station where the signal is received shall last a longer period, so as to obviate the necessity of exact synchronism in the movements of the mechanism at the two stations."

267. For an *Improvement in Sewing Machines;* Elias Howe, Jr., Cambridge, and Wm. R. Bliss, Boston, Massachusetts.

Claim.—"1st, In connexion with the mode of forming a seam by means of two threads, the seizing and holding of the loop of the needle thread after it is inserted by means of the point of the shuttle and finger, or their equivalent, and the withdrawing of the needle from the material to be sewed before the shuttle thread is passed through the loop. 2d, The combining and arranging of the mechanism which works the shuttle thread and the baster, or its equivalent, with the standard, and in connexion therewith so arranging the mechanism which works the needle thread, as that they shall co-operate and form the seam when the standard is inserted in objects of a tubular form."

268. For an *Improved Permutation Lock;* Frank G. Johnson, Brooklyn, New York.

Claim.—"The combination together of the tumblers (using two or more of said tumblers) with the exterior pins, and the pins with the springs, the bolt, and locking latch."

269. For an *Improvement in Metallic Packing for Steam Pistons;* Daniel Lasher, Brooklyn, New York.

Claim.—"The manner of constructing the bent or folded metallic springs to take an even and extended bearing on the inner side of the packing ring or rings, when provided with the lips or projections, to keep the springs properly in place."

270. For an *Improvement in Iron Truss Frames for Bridges;* Francis C. Lowthrop, Trenton, New Jersey.

Claim.—"The straining plate, in combination with the rods, when the latter are connected to the plate, and when the said plate is arranged to receive the vertical or verticals and diagonals of iron truss frame bridges."

271. For an *Improvement in Self-acting Rakes for Harvesters;* Salem T. Lamb, New Washington, Indiana.

"The invention relates to the construction and peculiar operation of a self-acting raking apparatus."

Claim.—"In combination with a rake having the motions, the gyratory beam, and the rock shaft, when the rake is attached to said rock shaft. Also, in combination with a rake operating the slotted guard for regulating or governing its motions, when combined with the beam and shaft. Also, in connexion with a rake having the motions, the combined use of the spring for holding it to its work, and the set screw for regulating the extent of descent of said rake."

272. For an *Improved Sawing Machine for Felling Trees;* Matthew Ludwig, Boston, Massachusetts.

Claim.—"The combination of the vibrating radius with the pitman and saw-stock, for the purpose of guiding and rocking the saw circularly in its own plane."

273. For an *Improvement in Printing Ink;* George Matthews, Montreal, Canada East.

Claim.—"The use of the calcined green oxyde of chromium for making ink for printing from engraved plates, from types, or for other kinds of printing."

274. For an *Improvement in Valve Gear for Steam Engines;* Sidney Maltly, Dayton, Ohio.

Claim.—"The means for effecting the reverse cut-off and lead, when said means are arranged directly on the wrist of the engine crank, and used as a substitute for the common link and hook motions."

275. For *Improved Raking Attachments for Harvesters;* John McIntosh, Geneva, Illinois.

Claim.—"The peculiar method of withdrawing and releasing the sliding plate when the same is used in combination with the endless belt."

276. For an *Improvement in Harvesters;* David S. McNamara, North Hoosick, New York.

"The invention relates to a novel means employed for raising the sickle, when it is required to back the machine."

Claim.—"Connecting the shaft by means of the arm and link, with the rod placed at the underside of the draft pole, and connected with the yoke ring."

277. For an *Improved Fence;* James Moore, Pittsburgh, Pennsylvania.

Claim.—"The use of lozenge-formed slats, and the alternate twisting of the wires between the slats."

278. For an *Improved Frame for Combined Mowers and Reapers;* J. A. Moore and A. H. Patch, Louisville, Kentucky.

Claim.—"Making the rear and outer end of the frame of a combined mower and reaper of a single bar of angle iron, when said bar is bent into the form, and united to the frame bars, and to the finger bar and shoe."

279. For an *Improvement in Chilling Plough-shares;* James Oliver and Harvey Little, South Bend, Indiana.

Claim.—"The process consisting in placing the surface of the chill in such a position in relation to the other parts of the mould, that the melted metal shall first come in contact with the chill at the edge of the share."

280. For *Elastic Loop for Suspending Bedstead Slats;* Charles Robinson, Cambridgeport, Massachusetts.

Claim.—"An elastic self-attaching loop for bedstead slats, as a separate article of manufacture not heretofore known."

281. For an *Improvement in Street Lanterns;* John Reese and Charles N. Tyler, Washington, D. C.

Claim.—"The arrangement of the funnel-mouthed aperture, and the valve in the bottom of the lamp."

282. For an *Improvement in Modes of Preserving Green Corn;* David Rowe, Baltimore County, Maryland.

Claim.—"The art and process of preserving green corn in the ear by extracting the pith or heart of the cob, and seasoning and drying the inside of the cob as rapidly as the outside, for preserving the virtues and juice of the grain, and preventing the collection of mold or corruption."

283. For an *Improvement in Fire Arms;* Jacob Shaw, Jr., Hinckley Township, Ohio.

Claim.—"1st, The combination and arrangement of the trigger with the cocking ratch and hammer, whereby the force of the main spring will cause the trigger to continue its motion in a backward direction after it has been forced back to a certain point,

and the introduction of the hair trigger, whereby the trigger may be arrested when it has reached that point, and the hammer by this means be held at the cock point, or by simultaneous action of a force on the hair trigger, in a backward direction, the backward motion of the hair trigger may be allowed, and a consequent disengagement of the hammer be produced to effect a discharge. 2d, The combination and arrangement of the trigger with rotator ratch and locking lever, and the revolving chambered cylinder or block, whereby this block is revolved and locked from the front, instead of the usual mode of the ratchet wheel and pawl in the rear, intending and designing hereby to claim each part and all the parts named in the above claims, in connexion with each other, without intending to limit myself to construct them in the precise form, or of any particular dimensions, but intending to reserve the right to vary them as I may deem expedient, while I attain the same ends by means substantially the same."

284. For an *Improved Mode of Opening and Closing Farm Gates;* Wm. Sherwood, Beloit, Wisconsin.

Claim.—"The use of the crank, in combination with the latch, or its equivalent, and the weight for the purpose of opening and shutting a sliding gate, in which arrangement the gate is opened by one-half revolution of the crank, and shut by the other half revolution of the same; the latch stopping the crank at the end of each half revolution, and the whole being set in motion by a weight, which may be wound up when necessary like the weight of a clock. Also, the arrangement and combination of the lever and the connecting rods with the two parts of the gate, by means of which one part of the gate, when moving in one direction, opens or closes the other part of the gate by a corresponding motion at the same time in the opposite direction."

285. For an *Improved Brake for Wagons;* Hugh Slater, Auburn, New York.

"The invention consists in a peculiar arrangement and combination of devices by the tongue-shaped connexion bar or rod, with its connexion therewith, and with the box arms, by which the forward motion of the wheels may be retarded when required, and the backward motion not impeded."

Claim.—"1st, The peculiar arrangement and combination of devices by means of the tongue or pole, the hinge, the U shaped connexion, the brake rod or bar, and the connexions with the brake arms. 2d, The combination of the pole or tongue, and stop bar, with the sliding bar, or its equivalent, whereby the stop is raised when the carriage is backed, and lowered when it is moved forward."

286. For an *Improved Mortising Machine;* Hezekiah B. Smith, Lowell, Mass.

Claim.—"1st, The adjustable compound treadle, when used in combination with a mortising machine. 2d, The pawl, or its equivalent, in combination with the table, to prevent the action of the chisel from jarring the foot, not intending by this to confine myself to the exact form represented, but adopting any other substantially the same."

287. For an *Improvement in Cartridges;* Gilbert Smith, Buttermilk Falls, N. Y.

Claim.—"Making the cartridge case, or at least the cylindrical portion thereof, of india rubber cloth or vulcanized india rubber, so that though entering loosely into the chamber, by confining it within the chamber, it may be expanded laterally by the force of the explosion of the charge against a joint between the barrel and breech, made near the middle of the chamber to close the same hermetically, and (unlike metal) may after the explosion contract itself by its own elasticity, so as to admit of its being easily withdrawn from the chamber by the fingers of the operator."

288. For an *Improved Raking Apparatus for Harvesters;* Daniel C. Smith, Tecumseh, Michigan.

Claim.—"The mode of operating the rake of a grain harvester, by means of the mechanism."

289. For an *Improvement in Gas Generators;* John W. Smith, Washington, D. C.

"My improvement relates more particularly to the retort and its immediate appurtenances, of a cheap and portable apparatus for the manufacture of gas for illuminating purposes, from oil or other fatty matter, for use in families."

Claim.—"The combination of the retort with the partitions, when the said partitions are furnished with openings arranged in such a manner that the oil or other fatty matter, and the gas produced by its decomposition, shall flow through the retort in currents crossing each other, and alternately dividing and uniting."

290. For an *Improvement in Harvesters;* Charles T. Stetson, Amherst, Mass.

Claim.—"Attaching the finger bar to the frame by means of the guides and the grooved segment guides, the inner end of the bar being provided with friction rollers, which work in said segment guides."

291. For an *Improvement in Manufacture of Journal Boxes for Shafting, &c.;* Daniel Taylor, Carbondale, Pennsylvania.

Claim.—"A journal box or section of a journal box composed of a brass lining and an iron body, when the two are solidly united together by casting the latter upon the former."

292. For an *Improved Die Stock;* James Teachout, Waterford, New York.

Claim.—"Constructing the die holder of the screw cutting die stock in the particular manner, so as to give firm support to the inner portion of the top of the dies as well as to their bottoms and sides, and thereby relieve the scroll and guard plates from all the upward strain or pressure otherwise exerted upon these plates by the inner portion of the dies in cutting screws."

293. For an *Improvement in Coloring Yarn in the Bobbin;* James Thomson and Wm. P. Wakelee, New Hartford, New York.

Claim.—"The use of a vacuum in combination with our arrangement of apparatus, to render the same available in the dyeing of yarn in the cop, bobbin, and the like, without first reeling it into hanks or skeins."

294. For an *Improvement in Resinous Compounds for Covering Hams;* Carter Van Vleck, Macomb, Illinois.

Claim.—"The composition for covering hams or other bodies, consisting of rosin, gutta-percha, and tallow."

295. For an *Improvement in Starch from Maize;* Wm. Watt, Belfast, Ireland.

Claim.—"The manufacture of starch from maize or indian corn, by steeping the whole or uncrushed corn in water heated to a temperature of from seventy to one hundred and forty degrees, Fahrenheit's thermometer, such water being changed several times during the steeping, or applied in continuous or intermittent streams, and then grinding or levigating it with water heated to a temperature of from seventy to one hundred and forty degrees of Fahrenheit's thermometer, and then separating the starch."

296. For an *Improvement for Condensing Liquids in Gas Main Pipes;* John Walton, Louisville, Kentucky.

Claim.—"The employment at any convenient place or places in the gas pipes of one or more vessels or receptacles containing alcohol, or other hygrometric agent."

297. For an *Improvement in Slide Valves for Steam Engines;* Thomas Winans, Baltimore, Maryland.

Claim.—"The connecting of the passages through the ends of the main valve, denominated the Myers' valve, by the channel or openings."

298. For an *Improvement in Defecating Cane Juice;* Leonard Wray, London, England; patented in Belgium June 20, 1854.

Claim.—"A new process, being one whereby excellent crystallized sugar has been and can always be made from the plants; I therefore claim the process."

299. For an *Improvement in Locks;* Ludwig Baier, Assignor to Joseph Lippincott and Wm. C. Barr, Pittsburgh, Pennsylvania.

Claim.—"1st, The sliding tumbler box carrying the tumblers, which by the sliding motion of the box are brought into contact with the bits of the key. 2d, The three armed 'follower,' when arranged, constructed, and operating on, and in combination with, the tumbler box, bolt, and tumblers, with their slots. 3d, The key when constructed so as to form a double bit plate, and operating on the tumblers."

300. For an *Improvement in Ships' Capstans;* Robert Dunbar and John F. Robertson, Assignors to The Buffalo Eagle Iron Works Co., Buffalo, New York.

Claim.—"The arrangement of the cam and eccentric upon the shaft, operated by the lever for throwing in and out of gear the pinions."

301. For an *Improved Automatic Rake for Harvesters;* Joseph S. Manning, Philadelphia, Pennsylvania.

Claim.—"The raking device, consisting of cross-bar, teeth, and swinging bars, and supporting roller, when the same is used in combination with the peculiarly constructed platform."

302. For an *Improvement in Strap Pillow Block for Shafting, &c.;* George H. Reynolds, Medford, Massachusetts, Assignor to self and D. C. Hinckley, Bangor, Maine.

Claim.—"The journal box consisting essentially of the pieces or bushings, and strap."

303. For an *Improvement in Sewing Machines;* Wm. Sage, Durham Centre, Assignor to Henry Sage, Berlin, Connecticut.

Claim.—"1st, Combining the spring stop plate with the needle and loop former. 2d, Giving the point of the loop former an upward motion as the needle rises, and the point of the loop former expands to form the loop. 3d, The construction of the loop former and its arrangement in connexion with the trip and slide, by which it is made to open to spread the loop for the reception of the needle, and close to enter the next loop."

304. For an *Improved Arrangement of Valves in Steam Cylinders;* M. E. Stacy, Assignor to W. John Way, Flemington, Georgia.

Claim.—"The arrangement of valves in steam cylinders."

305. For an *Improved Cross-cut Sawing Apparatus;* Henry F. Wilson, Assignor to self and Henry B. West, Elyria, Ohio.

Claim.—"The radius bars, in combination with the vibrating bars, for the purpose of straining the saw so as to enable me to give the saw a reciprocating motion without guides. Also, placing pins at a greater or less distance apart than pins for the purpose of giving a rocking motion to the saw while reciprocating, said motion to be graduated according to the kind of wood to be sawed."

Additional Improvements.

1. For an *Improved Farm Gate;* Charles N. Cole, Pleasant Valley, New York; patented May 13, 1856; additional dated June 9, 1857.

Claim.—"The arrangement and combination of the levers with the ropes or chains and platforms, they forming a self-acting or balance gate."

2. For an *Improved Cutter for Boring Wheel Hubs;* Leonard S. Maring, Fall River, Massachusetts; patented October 4, 1853; additional dated June 16, 1857.

Claim.—"1st, An additional reamer connexion with the shaft. 2d, A serrated, notched, sickled, or ragged edge of reamers or cutters."

3. For an *Improved Spoke and Axe Helve Machine;* Owen Redmond, Rochester, New York; patented October 30, 1855; additional dated June 23, 1857.

Claim.—"The jointed guides having slots, in combination with the slots having a relative position."

4. For an *Improved Sawing Machine;* Wm. P. Wood, Washington, D. C.; patented February 26, 1856; re-issued March 25, 1856; additional dated June 23, 1857.

Claim.—"The vertical guides and guide rollers, in combination with the swivel link saw bearings."

Re-Issues.

1. For an *Improvement in Grass Harvesters;* Wm. F. Ketchum, Buffalo, New York; patented February 10, 1852; re-issued February 28, 1854; re-re-issued June 2, 1857.

Claim.—"1st, Extending the shoe from the heel of the rack or finger bar upward and forward, and firmly connecting its continuation with the draft, when the finger bar is located so that the power by which the machine is drawn shall, through the shoe, be communicated to and draw forward the heel of the rack or finger bar, thus relieving

the great strain which would otherwise come upon the lateral connexions of the rack or finger bar with the wheel frame, while the heel is enabled to slide over obstructions. 2d, When the main wheel and inner end of the finger bar or rack are located relatively, I claim continuing the shoe from the heel of the rack or finger bar upward and forward until the upper end of its extension reaches a part of the machine which always runs above the mown grass, and which will keep the said grass down, and prevent its rising over the point of the extended shoe, thus aiding the shoe to ride over the mown grass even when accumulated. 3d, Supporting the heel of the rack or finger bar sufficiently near the ground, and at a convenient distance laterally from the main wheel, by arms extending upwards and forwards, and upwards and backwards therefrom, and connected with the frame or spring bars firmly bolted across the frame in front and rear of the said rack or finger bar, while the said frame and bars are elevated to pass over the cut grass. 4th, Supporting the rack or finger bar at the side of, and lower than the main frame, by means of auxiliary framing in a fixed position at the side thereof, and extending downwards and forward, so that while the finger bar is held as near the ground as desired, and lower than the main frame, the main frame may be nearly horizontal in the line of draft, and at any convenient height to avoid clogging or accommodate the diameter of the main wheel; such an auxiliary frame composed of bar, rods, and rack or finger bar, but its details may of course be varied, while the principle is retained. 5th, Supporting the rack or finger bar in its position at the side of, and lower than, the main frame, by extending a strong bar behind said rack or finger bar, firmly supported by said frame, and rigidly connecting said rack or finger bar to said bar by a straight brace or braces, said frame being elevated, and said bar being elevated and placed sufficiently in rear of said rack and finger bar to avoid clogging or lodging of the mown or falling grass against, when said parts are arranged in relation to each other. 6th, Supporting the outer end of the rack or finger bar by a rod extending downwards and forwards from the cross-bar to the finger bar, parallel or nearly so to the face of the main wheel, when the frame and bar are elevated above the rack or finger bar, in the manner and for the purposes contemplated in the last claim, to avoid the falling or clogging of the cut grass against such rod."

2. For an *Improvement in Gas Burners;* Charles H. Johnson, Boston, Massachusetts; patented June 26, 1855; additional dated March 18, 1856; re-issued June 2, 1857.

Claim.—"Combining the gas distributor or the same and the purifier, with the burner so as to operate therewith. Also, elevating the top of the orifice for injecting the gas into the chamber of the burner above the base of said chamber, by a cone, or its equivalent, and so as to form a channel around said orifice for holding tarry matter, as well as for removing it from the orifice. Also, extending the orifice into the distributor, and among its wires, so as to attain advantages."

3. For an *Improvement in Cast Iron Car Wheels;* Anson Atwood, Troy, New York; patented May 15, 1847; re-issued June 9, 1857.

Claim.—"The connecting of the rim of the wheel with the hub in cast iron car wheels, by means of two curved plates starting from near the ends of the hub, and joining at a part of the distance between it and the rim, thus forming a hollow ring or arch around the hub, and joining said ring with the rim by a single plate, or its equivalent, for the uses."

4. For an *Improvement in Ships' Blocks;* Cornelia Waterman, administratrix of Stephen Waterman, deceased, and Isaac D. Russell, City of New York; patented January 31, 1844; re-issued June 9, 1857.

Claim.—"Passing the straps through grooves in the inner faces of the cheeks of the blocks."

5. For an *Improvement in Locomotive Tenders;* Ross and Thomas Winans, Baltimore, Maryland; patented May 23, 1854; ante-dated May 9, 1854; re-issued June 16, 1857.

Claim.—"The tender with an upper and lower platform, in combination with and for the purpose of feeding with greater convenience the furnace of a locomotive steam engine, having upper and lower feeding holes."

6. For an *Improvement in Locomotive Fire Box;* Ross and Thomas Winans, Baltimore, Maryland; patented May 9, 1854; re-issued June 16, 1857.

Claim.—"The downward and rearward inclination of the top or roof, in combination

with the flat grate surface, and the usual feeding hole or door, and with or without the fuel feeding boxes through the roof."

7. For an *Improvement in Means for Guiding Line Ferry Boats or Flying Bridges;* Wm. A. Jordon, Thibodeaux, Louisiana; patented August 5, 1856; re-issued June 16, 1857.

Claim.—"Adjusting the boat relatively with the cable or rope, or by any mechanism, when said mechanism is so arranged as not only to effect the adjusting or turning the boat, but also to retain it when adjusted."

8. For an *Improvement in Flouring Mill;* Joseph Weis, Bordentown, New Jersey; patented January 29, 1856; re-issued June 16, 1857.

Claim.—"The tapering burr, when covered with steel plates, having teeth in disjointed lines, and oblique with the axis of the burr, in combination with the steel pieces, having also oblique teeth, but inclined in a contrary direction to those of the burr, and being dove-tailed into projections cast to the shields, the said projections forming longitudinal grooves running lengthwise on the cone, and crossing the inclined dress."

9. For an *Improved Portable Field Fence;* James G. Hunt, Cincinnati, Ohio; patented December 16, 1856; re-issued June 30, 1857.

Claim.—"Connecting the panels or sections of a fence by the projections of one or more rails in whole or in part from one section or panel beyond the slats or battens, and between the slats or battens of the adjoining panel, and supporting and locking the fence by compound triangular braces, and arranged with reference to the projection of the rails."

10. For an *Improvement in Looms for Weaving Pile Fabrics;* Mertown C. Bryant, Lowell, Assignor to E. B. Bigelow, Boston, Massachusetts; patented May 19, 1850; re-issued June 30, 1857.

Claim.—"1st, The method of transfering the pile wires in series from the cloth to the shed of the warps. 2d, The method of successively cutting the rows of loops or pile on the pile wires."

11. For an *Improvement in Machines for Manufacturing Hat Bodies;* James S. Taylor and Elijah Sturdevant, Danbury, Connecticut, and as administrators of Hiram L. Sturdevant, dec'd., Assignees of Lansing E. Hopkins, City of New York; patented December 7, 1852; re-issued June 30, 1857.

Claim.—"The method of felting hats by passing them or rolling them between the revolving endless planking table, and a series of rollers, or their equivalent, whereby a vibrating, reciprocating, and forward motion is communicated to the hats, thereby working it up in a perfect manner. But this we claim, only when the vibrating and reciprocating motion is communicated to the hats in the direction of the revolving motion of the traveling belt, so as to give the hats a rolling motion alternately forward and back as they pass through the machine."

DESIGNS.

1. For *Cooking Stoves;* Thomas H. Wood, Henry S. Hubbell, and John E. Roberts, Utica, New York; dated June 2, 1857.

2. For *Cook's Stoves;* John D. Marshbank, Lancaster, Pennsylvania; dated June 2, 1857.

3. For *Busts of Napoleon Bonaparte;* Thomas Ball, Boston, Massachusetts; dated June 9, 1857.

Claim.—"The new design for a bust of Napoleon Bonaparte."

4. For *Stoves;* S. W. Gibbs, Albany, New York, dated June 16, 1857.

5. For *Coal Cooking Stoves;* Conrad Harris and Paul W. Loiner, Cincinnati, Ohio; dated June 23, 1857.

6. For *Wood Parlor Stoves;* Conrad Harris and Paul W. Loiner, Cincinnati, Ohio; dated June 23, 1857.

7. For *Dining Room Stoves;* Conrad Harris and Paul W. Loiner, Cincinnati, Ohio; dated June 23, 1857.

8. For *Cooking Stoves;* S. W. Gibbs, Albany, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated June 23, 1857.

9. For *Stoves;* N. S. Vedder, Troy, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated June 23, 1857.

10. For *Stoves;* Jacob Beesley and E. J. Delaney, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated June 23, 1857.

The claims on the above, with the exception of No. 3, are for the several shapes, forms, and ornaments.

JULY 7.

1. For an *Improvement in Machines for Husking Corn;* George W. Bachman, Clifton Springs, New York.

Claim.—"The grooved cylinder wires and knife, in combination with the reciprocating screen, provided with clearing teeth, and reciprocating toothed board, the whole being arranged to operate conjointly."

2. For an *Improved Metal Separator;* Edward Borlase, Bristol, Connecticut.

Claim.—"The use of the conical reservoirs, when arranged in connexion with the sieves."

3. For an *Improvement in Truss Bridges;* Josiah Brown, Jr., Buffalo, New York.

Claim.—"Providing each of the main and counter braces with two gains at top and bottom, and each of the timbers of the chord with a gain at a point where the braces are applied corresponding with the gains in the braces, and passing the braces thus formed up between the timbers with the gains of the braces in such relation to the gains of the timbers, that when the timbers of the chords are brought together they are combined, and become as it were only one piece, no part of which can be operated upon or affected independently of the other, by the downward and upward thrusts common to truss bridges, even if the bolt which passes laterally through and intersects each set of braces and the timbers of the chord were removed."

4. For an *Improved Machine for Cutting Paste-board, &c.;* Denzlow Burhaus, Burlington, Iowa.

Claim.—"The employment in connexion with the grooved feed rollers, of a double-edged or V shaped cutter. Also, the combination of the steadying roller with the feed roller."

5. For an *Improvement in Steering Apparatus;* Dexter H Chamberlain, West Roxbury, Massachusetts.

Claim.—"The nuts with their vibrating feathers, in combination with the parallel shafts, when the said nuts rest against, and are guided by, the middle shaft."

6. For an *Improvement in Instruments for Cutting Button Holes;* William Chicken, Boston, Massachusetts.

Claim.—"My improved button hole cutter."

7. For an *Improved Air Chamber to Effect Uniformity of Flow of Water, etc., through Pipes;* Thomas Clark, Philadelphia, Pennsylvania.

Claim.—"The arranging of an elastic or extensible sack or bag in the line of a pipe or water way, when said sack is surrounded with a casing and air chamber."

8. For an *Improved Alcohol Blow Pipe;* Edward Conway, Dayton, Ohio.

Claim.—"The use of the compound regulator of the safety valve, in combination with the tubes and the three-way cock of the boiler."

9. For an *Improvement in Grain Separators;* Amasa Curtis, Lena, Illinois.

Claim.—"The auxiliary shoe provided with the adjustable slats, in combination with the valves in the fan box."

10. For an *Improvement in Corn Harvesters;* Israel Dodenhoff, Bloomington, Illinois.

Claim.—"1st, The arrangement of the knives in relation to each other, when combined with the peculiar shape of the teeth. 2d. The armed belt and spring guide bars, for holding, guiding, and carrying the corn, so as to deposit it in the arms of the col-

lector, in the rear of the machine, in combination with the cutting apparatus, the whole being arranged in relation to each other."

11. For an *Improved Box Window Frame;* Joseph B. Dodge, St. Louis, Missouri.

Claim.—"The employment of the beads commonly used in window frames to hold the sash to their place, to form the box for the weights, using grooves for that purpose on the inside of the jamb, and on the underside of the beads, placed together, forms the box for the weights."

12. For an *Improvement in Machines for Husking Corn;* William Emery, Jr., Chester, Illinois.

Claim.—"The combination of the rotating hub and knife, inclined box or trough, and stripping hooks, when the above parts are arranged to operate."

13. For an *Improvement in Dry Sand Cores;* Wm. Gage and Richard B. Felthousen, Buffalo, New York.

Claim.—"The application and use of glue or blood (either separately or in combination), mixed with sand, for the purpose of making dry sand cores for founding purposes."

14. For an *Improvement in Self-priming Gun Locks;* Mahlon I. Gallager, Savannah, Georgia.

Claim.—"The shipper which relieves the sliding rod, and allows the fire arm to which the improvement is attached, to be used with the ordinary percussion cap, without exhausting the primers from the cylinder, or for the convenience of sportsmen, and without which a self-capping hammer is valueless to sportsmen."

15. For an *Improved Machine for Tapping Nuts;* Almon B. Glover, Birmingham, Connecticut.

Claim.—"1st, Giving the arbor simultaneous with its reciprocating rotary motion, a longitudinal movement back and forth by means of the collar placed on the shaft, and provided with the spiral grooves and inclined or oblique end, and the bar which is placed loosely on the shaft, and connected with said collar. 2d, The employment or use of the spring placed within the sleeve, and the spring placed on the shaft and connected with the arms, for the purpose of allowing the arbor and arms an independent movement, and thereby preventing any injury which might otherwise be produced by any irregularity in the feeding of the blanks within the tap box."

16. For an *Improved Device for Securing the Stock to the Guide Rods of Joiners' Ploughs;* Stephen Going, City of New York.

Claim.—"Securing the stock on the guide rods by means of the bar, fitted within the stock, and actuated by the screw."

17. For an *Improved Machine for Straightening Veneers;* Joseph H. Goodell, Bridgeport, Connecticut.

Claim.—"The reduction or removal of the curve or scroll shape given the veneer in its cut from the log or stick, by the introduction and feed of it endwise, that is, transversely to the general direction of the curve assumed by it in the cut between a roller or rollers, and carrying and pressing apron, arranged for operation together and on the veneer. Also, in combination with the several rollers and endless carrying and pressing apron, when the same are relatively arranged, the adjustable frame to the one roller, to give increased or diminished pressure to the apron against the back of the pressing roller, or interposed veneer."

18. For an *Improved Wrench;* John H. Hathaway, Millbury, Massachusetts.

Claim.—"Making the ratchet or part corresponding thereto of separate pieces between which the catch enters. Also, the adjustable ratchet or series of slips, in combination with the stationary and sliding jaws, or their equivalents."

19. For an *Improvement in Upsetting Tires;* Rockwell Hansen and Volney Gibbs, Homer, Michigan.

Claim.—"The sliding blocks with knives attached, and the heads fitted in slots in the plates to which the blocks are attached, the inner blocks having knives attached, which knives are actuated by the wedges, the above part being used in connexion with the plates; it being understood that we do not claim separately either of the parts, but the whole when arranged to operate conjointly."

20. For an *Improved Cutting Apparatus for Harvesters;* Joseph Irwin, Frankfort, Ohio.

Claim.—"The spiral cutter, when the same is arranged below, and used in combination with, the curved cutting fingers."

21. For an *Improvement in Locks;* Henry Isham, New Britain, Connecticut.

Claim.—"Combining with the mechanism for throwing the bolt, or any equivalent therefor, a mechanism which rotates with the said bolt throwing mechanism, and which by such rotation at the end of the throw of the bolt interposes its periphery to the line of travel of the bolt, or some part of it, and thereby prevents the bolt from being forced back, until the bolt throwing mechanism is brought to the required position for throwing back the bolt. Also, the combination of the non-cogged sectors, and the cogged sectors on the key-bit, with the cogs and projections on the tumbler slides, or any equivalent therefor, whereby the said slides are controlled by the key-bit. Also, the mode of imparting intermittent motion to the key-bit, and stopping the same, while the mechanism which imparts such motion continues to move by means of the wheel and pinion, having their engaging peripheries constructed as described."

22. For an *Improved Method of Backing Electrotype Plates;* Albert H. Jocelyn, City of New York.

Claim.—"Backing shells for printing embossing and like purposes, by pressing type or other suitable metal down upon the shell while in a fluid or elastic state."

23. For an *Improved Method of Connecting the Panels of Field Fences;* Samuel F. Jones, Milford, Indiana.

Claim.—"The method of connecting the panels of a field fence, by tongues and grooves, and hook combined."

24. For an *Improvement in Belt Shifter for Machinery;* Lucius J. Knowles, Warren, Massachusetts.

Claim.—"1st, Shifting a belt or band from one pulley to another by means of two rollers capable of vibration, so as to be set slightly oblique, either to the right or left, to a line at right angles with the edge of the belt or band. 2d, The peculiar construction of the upper roller. 3d, Having the roller capable of sliding on its axle, as it shifts the belt."

25. For an *Improvement in Sewing Machines;* E. T. Lathbury, Buffalo, New York.

Claim.—"The looper composed of two elastic pointed fingers, and operating in combination with the needle, so that the needle passes through the looper while the loop is extended upon it, then escapes from it by opening its point as the looper is withdrawn from the loop."

26. For an *Improved Cutting Apparatus for Harvesters;* John P. Manny, Rockford, Illinois.

Claim.—"Causing a series of cutters to cut from right to left, and from left to right, between each pair or set of fingers, at every single revolution of said series of cutters upon their shaft or journals. Also, in combination with such series of cutters, the recesses in the sides of the fingers, into which they may enter to enable them to clear themselves from the clogging matter that gathers and accumulates (unless somehow prevented) in all harvesting machines."

27. For an *Improvement in Paper Cop Tubes;* Alexander McCausland, Providence, Rhode Island.

Claim.—"The paper cop tube made of a strip of paper of the form represented in the diagram, whereby greater strength is given to the base of the tube, while the desired conical form is at the same time attained."

28. For *Improvements in Railroad Car Stove;* James Spear, Philadelphia, Pa.

"My improvements relate to hot air stoves for warming the interior of railroad cars, where the supply of air is driven into the stove by the force of the wind, or of the current created by the rapidity of the motion of the cars."

Claim.—"The combination of the cross tube and its self-acting valves with the air tube, so constructed and arranged as to conduct the external air to the heater when the cars are in rapid motion, either forward or backward, and to prevent the escape of the heated air when there is no descending current."

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28. For *Improvements in Railroad Car Stove;* James Spear, Philadelphia, Pa.

"My improvements relate to hot air stoves for warming the interior of railroad cars, where the supply of air is driven into the stove by the force of the wind, or of the current created by the rapidity of the motion of the cars."

Claim.—"The combination of the cross tube and its self-acting valves with the air tube, so constructed and arranged as to conduct the external air to the heater when the cars are in rapid motion, either forward or backward, and to prevent the escape of the heated air when there is no descending current."

29. For an *Improved Gold Washer and Amalgamator;* T. V. Tavnay, San Francisco, California.

Claim.—"The metal plates coated with mercury, the riffles, vanes, and reacting surfaces."

30. For an *Improved Sash Lock;* Marcus P. Norton, Troy, New York.

Claim.—"Making a double window sash lock and fastener, with an upper and lower branch, which converge and unite into one at or near the knobs or upper end."

31. For an *Improvement in Cooking Stoves;* William Resor, Cincinnati, Ohio.

Claim.—"The combination with a customary reverting flue cooking stove of the funnel shaped descending flues, enclosing a reverberatory chamber, communicating with the central or reverting flue on one side of a supplemental oven, and with the escape flue on the other side."

32. For an *Improved Scroll Wheel for Harvesters;* Charles D. Rogers, Utica, New York.

Claim.—"Constructing scroll wheels of harvesters in two separate parts, when both the adjustable portions and main rim are constructed and arranged in the peculiar manner."

33. For an *Improved Air Heating Stove;* Charles B. Sawyer, Fitchburgh, Mass.

"This invention relates solely to an improvement in an air heating device, formerly patented by John Sawyer, in which a ventilating chamber, hot air flue, smoke flue, and air heating chamber are arranged and combined in a peculiar way for effecting the desired purpose."

Claim.—"The pipes for the admission of cold air direct into rooms when said pipes are made to pass through the ventilating chamber, for the purpose of creating the necessary draft, and used in connexion with the hot air pipes and ventilating pipes. Also, the chamber placed over the hot air flue and ventilating chamber, when arranged relatively with the flue chamber and pipes."

34. For an *Improved Shaft Coupling;* Edwin F. Shoenberger, Germantown, Pa.

Claim.—"The combination and arrangement of the levers with their half roller box, clip, and slot, for the purpose of being applied to shaft couplings for safety, and to prevent rattling."

35. For *Improved Whiffle-trees;* David A. Smith, Washington, D. C.

"This invention consists in an improved mode of attaching and detaching traces from whiffle-trees."

Claim.—"The lever attached to a fulcrum on plate, and sliding in slotted plate, for operating the spring bars alternately."

36. For an *Embossing and Printing Press;* Samuel Joseph Smith and Charles Lockle, City of New York.

Claim.—"The arrangement of the inking table, die, springs, roller, and its lever. Also, the raised metallic counter die for embossing, when covered with a thin coating of gutta percha, to enable said metallic counter die to give a perfect impression of ink from the embossing die on those parts of the paper that are not raised by the embossing die, simultaneously with said embossing."

37. For an *Improvement in Covering for Drawing Rolls;* Joseph M. Smith, Manchester, New Hampshire.

Claim.—"The use of black lead in combination with india rubber as a material for covering drawing or draft rollers, for the purpose of avoiding the effects of electricity, and the adhesion of the cotton to the rollers."

38. For an *Improved Melodeon Attachment;* D. L. Sprague, Townsend and Riley Burditt, Brattleboro', Vermont.

Claim.—"1st, The hammers of the 'harp attachment,' arranged between the keys and reeds of the melodeon, and combined with the inverted jacks attached to the bottom of the keys, whereby the ordinary keys of the melodeon are made to serve without any extension to play the harp attachment. 2d, The attachment of the string dampers of the 'harp attachment' to the melodeon keys. 3d, The employment of a bar extend-

ing below the whole of the hammers, and operating to move all the hammers simultaneously to such a position that the jacks are inoperative upon them."

39. For an *Improvement in Brick Machine;* Stephen Ustick, Philadelphia, Penna.

"This invention consists in the peculiar construction and combination of parts for pressing and discharging brick."

Claim.—"The piston and filling box when connected together, in combination with the movable and weighted mould box, and lower piston, when said parts are constructed and arranged to operate in relation to each other."

40. For an *Improved File Cutting Machine;* William Van Anden, Poughkeepsie, New York.

Claim.—"The arrangement of a bed on which the file blank is cut, having a forward positive feed motion, and an independent forward motion against the edge of the chisel, in consequence of the percussion of the hammer, and the difference of the resistance of the metal at the back edge of the chisel, wedging it forward at the time of cutting the teeth of the file to cause their upsetting. Also, the combination and arrangement of the bed on which the file blank is cut, with the triangular feed gate and side rails of the machine frame. Also, the combination and arrangement of the ratchet wheel spring, and detent pins, or their equivalents, in combination with the pawls for operating the same. Also, the use of the compound self-adjusting chisel holder stock, in combination with the chisel, whereby it is held rigidly in its place under the blow of the hammer. Also, the use of the triangular gate as a feed motion to my compound bed, in combination with the apparatus for operating the same."

41. For an *Improvement in Metallic Pens;* F. A. Wait, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the spring guard and slots in a pen."

42. For an *Improved Mode of Operating Radial Cutters in Lathes for Beaded Work;* George W. Walton and Henry Edgarton, Wilmington, Delaware.

"This invention consists in a cutting device peculiarly arranged and operated, for cutting the beaded or similar ornaments on the sticks."

Claim.—"The rotary pattern, bent lever, arms, connected to the sliding collar, in combination with the swinging or oscillating cutter stocks."

43. For an *Improvement in Method of Applying Railroad Car Brakes;* Ira J. Webber, Salem, Massachusetts.

"This invention consists in an apparatus for the purpose of operating the brakes of railroad cars, whereby the brakeman is enabled to apply the brakes of all the cars of the train by putting on the brakes of the hindmost car."

Claim.—"The apparatus for the purpose of applying railroad car brakes, consisting essentially of the sliding bolt and the dogs, or their equivalents."

44. For an *Improvement in Lifting Jack;* Heber G. Seekins and Charles H. Goss, Elyria, Ohio.

Claim.—"The concave and convex surfaces of the wedge, in combination with the concave surface of the upright, for the purpose of equalizing the direction of the pressure."

45. For an *Improvement in Machines for Trimming Hedges;* William Wimmer, Billingsville, Indiana.

Claim.—"The duplex arrangement of shears, both sets being actuated from the same driving-wheel, being adapted to trim simultaneously the top and one side of the hedge to any desired uniformity, height, and pitch."

46. For an *Improvement in Rock Drilling Machine;* Lemuel P. Jenks, Assignor to George A. Gardiner, Boston, Massachusetts; ante-dated January 7, 1857.

Claim.—"The use and application of the india rubber, when interposed in such manner that its expansive force shall operate the drill in rock drilling machines."

47. For an *Improvement in Rock Drilling Machines;* George A. Gardner, City of New York, Assignor to self and Lemuel P. Jenks, Boston, Mass.

Claim.—"The peculiar combination and arrangment of the devices, whereby the rotation of the mandrel and drill, as well as the gradual and proper advancement of both drill, mandrel, and frame, or either of them, is effected by means of a single eccentric on the cam shaft."

48. For an *Improved Gas Stove;* Patrick Mihan, Assignor to Robert .B Fitts, Boston, Massachusetts.

Claim.—"The combination and arrangement of the deflector with the conical or tapering cap, the gas receiving case, and the air passage. Also, the combination and arrangement of the perforated open tube or conductor and the secondary top with the oven, and so as to operate therewith, and not only improve its baking powers, but render it capable of applying heat to a kettle, or other article placed in or on said part or tube."

49. For an *Improvement in Pumps;* Henry Pease, Assignor to Eckler, Buswell & Co., Brockport, New York.

Claim.—"The guide rods constructed and arranged for the purpose of preventing the rotation of the piston, and of facilitating the attachment and detachment of the shaft to and from the crank."

50. For an *Improved Bit Brace;* Henry W. Porter, Rothsville, Assignor to Samuel G. Porter, West Earl, Pennsylvania.

Claim.—"Combining the knob with the bit holder by means of the auxiliary handle, whenever it may be necessary to bore holes in situations where it is impossible to rotate the bit brace. And in connexion therewith, I also claim the double ratchet wheels on the spindle, when arranged in such a manner in relation to the detent as to enable the necessary connexions and disconnexions to be effected between the bit holder and the permanent and auxiliary handles of the brace."

51. For an *Improved Bit or Drill Holder;* Amos J. Smith, Assignor to self and Geo. W. Otis, Lynn, Massachusetts.

Claim.—"The combination of the sliding key or bar and thimble, with the spring, and stationary catch or projection."

52. For an *Improvement in Gas Stoves;* Thomas Walters, Boston, Mass., Assignor to Stephen Sherlock, Eastport, Maine.

Claim.—"The combination of the main chamber of combustion, made to communicate by one or more passages with the main chamber, and having pipes extending through the chamber, and arranged so that air in passing through the said pipes may be heated by the heated products in the chamber. Also, the air and gas burner and supply pipe, in combination with the main and auxiliary chambers of combustion made to communicate with each other. Also, the combination of the reverberating bell or dome with its auxiliary chamber and the main chamber, when furnished with burners, and connected with one another and the external atmosphere."

53. For an *Improvement in Hay Rakes;* S. W. Wood, Washington, D. C., Assignor to Lewis H. Parsons, City of New York.

Claim.—"A hay rake consisting of a loose revolving tube, in combination with a segment wheel placed upon an axle, said tube being provided with the teeth of any desired form or material."

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54. For an *Improved Machine for Making Railrod Chairs;* Robert Archer, Richmond, Virginia.

Claim.—"The use of the swages operating in connexion with the adjusting levers, whereby uniformity in the length of the lips is secured without reference to the length of the plate."

55. For an *Improved Machine for Gauging and Filing Saws;* Emanuel Andrews, Elmira, New York.

Claim.—"The adjustable gauge and guide rollers, arranged and operating, by means of which the cutting angle or rake of the teeth shall be accurately gauged before filing, the rollers acting as stops to prevent the further cutting of the file when the proper point is attained. Also, the adjustable setting gauge, consisting of the movable jaws combined with the files or other cutting surfaces which shall be equivalent in their operation, for the purpose of gauging the width of set which the saw is to receive, and also for dressing and finishing the points of the teeth smoothly and uniformly after being set."

56. For an *Improvement in Fastening Artificial Teeth to the Metallic Plate;* Theodore H. and James P. Bradish, Utica, New York.

Claim.—"The construction and attachment of the linings in the manufacture of artificial teeth, by raising upon the back of the linings by which one or more series of separate anchors or projections are constructed, and when so formed and imbedded into the plastic material of the tooth at the time of the moulding, shall constitute the solid tooth and lining."

57. For an *Improved Pen and Pencil Case;* Edward Baptis, Hudson, N. J.

Claim.—"The employment or use of such grooves when made with a varying pitch."

58. For an *Improvement in Cultivator Ploughs;* George G. Black, Crossinville, Ohio.

Claim.—"The rod, arranged between the beams, and provided with a cross-bar, upon which the beams can vibrate when the ploughs are adjusted."

59. For an *Improved Nail Plate Holder;* William H. Battelle, New Castle, Penna.

Claim.—"A nail plate holder, composed of the socket, socket head, and guide, and the jaws held thereto by a ring."

60. For an *Improvement in Harvesters;* John P. Manny, Rockford, Illinois.

Claim.—"The combination of two frames, one of which is adjustable and can be raised or lowered at pleasure, with the lifting piece and platform hinged to said adjustable frame, when said parts are constructed and arranged to operate in relation to each other."

61. For an *Improvement in Rigging Ships;* James E. Cole, Brooklyn, New York.

Claim.—"Placing the centres of motion of the yards of a square-rigged vessel in line with each other."

62. For an *Improvement in Churns;* Charles H. Dana, West Lebanon, N. H.

Claim.—"The irregular curved pieces forming the undulating slot, in combination with the slotted oscillating frame and cross-bar, with friction rollers, for giving three up and down strokes to the dasher at each oscillation of the cream vessel."

63. For an *Improved Automatic Lathe;* Alexander Edmonds, Mount Pulaski, Ill.

Claim.—"The combination of the rotating cutter, provided with a gauge regulating the diameter of the rounds or cylinders with the nippers, for forming chair stuff. Also, the arrangement in the tenoning machine of the regulating screw and cap, with the chamfer chisel."

64. For an *Improved Device for Sealing Bottles, Cans, &c.;* Mills B. Espy, Philadelphia, Pennsylvania.

Claim.—"The combination of the upper plate having the slot and the two hooked projections, the lower plate having the screw hole and the two hooked projections, with the thumb-screw and jam nut, the same being adapted and arranged together so as to be applicable to the mouth of a bottle or jar."

65. For an *Improvement in Washing Machines;* Adam Fisher, Leavenworth City, Kansas Territory.

Claim.—"The combination of the bucketed wheel, constructed with the plain surfaced rubbing wheel."

66. For an *Improvement in Mattresses;* William P. Ford, Cheneyville, La.

Claim.—"A mattress of moss."

67. For an *Improvement in Corn Planters;* Alvin Franklin, Genoa Cross Roads, Ohio.

Claim.—"The combination of the plough-box extension and hoe in the rear of the planting tube or passage for operation together, and with an intermittent corn discharge or seed depositing arrangement. Also, providing the plough-box extension with a knife or scraper, arranged in relation to the hoe, for the purpose of clearing the latter in its back spring or stock."

68. For an *Improvement in Rope Machines;* Ezekiel Guile, St. Louis, Missouri.

Claim.—"The additional laying flyer. Also, the automatic stopping apparatus. Also, the curvilinear dies."

69. For an *Improvement in Setting out the Packing of Pistons for Steam Engines;* George H. Hoagland, Port Jervis, New York.

Claim.—"The setting out the packing by means of a tapering mandrel placed in the centre of the piston rod."

70. For an *Improvement in Piano Fortes;* G. Henry Hulskamp, Troy, New York.

Claim.—"1st, The arrangement and construction of the action of piano fortes, having the jack, under hammer, and springs attached to the key and moving in the same general direction with the hammer butt. 2d, The use and application of the spring, extending through the head of the under hammer to bear against the hammer butt. 3d, The regulating screw in the head of the jack, or its equivalent, in the head of the under hammer, to regulate the height of that part of the action. 4th, The shape of the hammer butt with its spiral spring. 5th, The dolce harmonic attachment, or its equivalent, and its parts, to wit, the interposing of a substance to touch one string only of a note, and the making of such substance to vary in hardness with the different notes of the instrument. 6th, The corrugated string."

71. For an *Improvement in Churns;* Silas Hewit, Seneca Falls, New York.

Claim.—"The floats, in combination with the flanches."

72. For an *Improvement in the Use of Coal Tar in Iron Furnaces;* Isaac G. Johnson, Spuyten Duyvel, New York.

Claim.—"The employment of coal tar in the air furnace."

73. For an *Improved Shot Cartridge;* William B. Johns, of the U. S. A.

Claim.—"The combination of the counter sunk base piece, copper disk, case, and felt disk."

74. For an *Improvement in Applying Fly-wheel to Hand Cars;* Charles T. Kipp and John Lawrenson, City of New York.

Claim.—"The arrangement of levers and rods attached to crank wheel for operating the fly-wheel."

75. For an *Improvement in Hemp Drawing Machines;* Samuel Lownds, Brooklyn, New York.

Claim.—"The arrangement of a hemp drawing frame, having its gills operated by guide dogs upon both sides of the frame, and attached to each alternate row of gills."

76. For an *Improved Seal for Car Doors, &c.;* D. W. Long, Baltimore, Maryland.

Claim.—"Effectually securing the seals of car or other doors from accidental or designed injury."

77. For an *Improvement in Cultivators;* Howard Mann, San Francisco, California.

Claim.—"The arrangement of shanks with rack-bars and segmental plates."

78. For an *Improved Raking Apparatus for Harvesters;* John P. Manny, Rockford, Illinois.

Claim.—"In combination with a contracting trough-shaped platform, a self-contracting and elongating rake. Also, raising and lowering a rake to cause it to preserve its relative working position with regard to the platform, as said platform is raised or lowered."

79. For an *Improved Device for Feeding the Cutter Intermittently in Mortise-boring Machines;* Hiram E. Paine, Troy, New York.

Claim.—"Constructing the machine so that the revolving sidewise reciprocating mortising bit thereof is moved by the machine alone, endwise into the timber, at, and only at, the ends of the mortise, whatever length of mortise is being cut. Also, the means used to prevent increased trembling of the mortising or boring bit as the depth of the cutting increases."

80. For an *Improved Spiral Catch for Breast Pins;* John F. Mascher, Philadelphia, Pennsylvania.

Claim.—"Constructing breast pins, brooches, and other ornamental fastenings for dress, &c., with a spiral catch."

81. For a *Seal for Railroad Freight Cars, &c.;* Henry D. Mears and Wm. Houlton, Jr., Baltimore, Maryland.

Claim.—"The device for sealing, the same consisting of soft metallic disks connected by a strip or wire of hard metal."

82. For a *Seal for Railroad Freight Cars, &c.;* Henry D. Mears and Wm. Houlton, Jr., Baltimore, Maryland.

Claim.—"The seal, the same consisting of a disk of soft metal, having one or more holes or slots through it for the reception of the ends of a wire or metallic strip, which are confined by the compression of the disk."

83. For an *Improved Self-setting Trap Hook;* Donald McLean, Boston, Mass.

Claim.—"The combination of the hooks with the elastic cord or spiral spring and line."

84. For an *Improvement in Locks;* L. F. Munger, Le Roy, New York.

Claim.—"The combination of the wheels with the arbor, said wheels being retained in position, and imparting motion to each other."

85. For an *Improved Mode of Constructing Carriages;* Rufus Nutting, Randolph, Vermont.

Claim.—"The arrangement of compensating springs with the front and rear axles, so that while the axles are retained in their proper positions, the action of the compensating spring prevents the spreading of the axles on one side of the vehicle, and thereby tends to preserve the accurate tracking of the hind wheels. Also, the combination of the guard with the hinder part of the springs."

86. For an *Improvement in Cotton Gins;* Daniel Pratt, Prattville, Alabama.

Claim.—"The ledge secured or placed within the hopper or box, so as to close the central portion of the lower end of the hopper or box, and cause the cotton when fed into the box to be fed spirally to the saws from the centre of the box towards each end."

87. For an *Improvement in Lime Kilns;* Leonard Phleger, Philadelphia, Penna.

Claim.—"The employment in a lime kiln of a series of water cells for supporting the limestone."

88. For an *Improvement in Locking Cylindrical Door Bolts;* Charles G. Page, Washington, D. C.

Claim.—"Locking the bolt by means of the loose handles."

89. For an *Improved Draining Machine;* A. P. Routt, Somerset, Virginia.

Claim.—"The employment in connexion with a double mould board plough, of a heavy V shaped or taper roller, said roller being hung so as to run behind and between the two mould boards, and so as to be capable of revolving and adjusting itself to the different depths at which the plough may be set to cut."

90. For an *Improvement in Oil Cans;* George W. and George H. Simmons, Bennington, Vermont.

Claim.—"Fastening the air vessel or tube to the oil tube, and the oil tube to the stopper, so that the whole may be removed together for the purpose of cleansing or repairs, by which means we produce a better article of manufacture than when said tubes are fastened to the can and are not removable."

91. For an *Improved Fly-Trap;* William T. Shannon, Greensboro', Georgia.

Claim.—"The invention of the box and the bag, and its attachment to the box, for the purposes heretofore mentioned."

92. For an *Improvement in Wrest Pins for Pianos;* Gustav Schilling, Hoboken, New Jersey.

"This invention consists in attaching the string to the end of an adjustable screw in such a manner that by raising or lowering the screw, the straining or unstraining of the string is effected exactly in the same vertical direction with the axis of the screw, by which arrangement all lateral pressure on the screw is avoided, and all injury to the several parts of the wrest pin as well as to the string is rendered impossible."

Claim.—"Combining the heads of wrest pins with an adjustable screw, to which

the string is attached, in such manner that the direction of the straining force is mathematically true in the direction of the axis of the adjustable screw."

93. For an *Improved Machine for Cutting Metal;* James Tetlow, Salem, Mass.

Claim.—"The forming of the cutter with an obtuse angle, in such a manner as to give to the surface of the plate, while being cut, a broad, flat bearing to rest upon while the other cutter is cutting through the plate; the obtuse angle of the cutter being the supplement of the acute angle of the plate when cut."

94. For an *Improved Centring Machine;* Edward F. Whiton, West Stafford, Conn.

Claim.—"Arranging the laterally adjustable notched holders in such a manner in relation to the longitudinally adjustable spindle, and its pointed marker, as to enable the ends of shafts of various sizes to be centrally marked."

95. For an *Improvement in Locks;* William Whiting, Roxbury, and Henry Pickford, Boston, Massachusetts.

Claim.—"The combination of the slides with the pawl, so arranged that whenever the slides are allowed to touch the tumblers, the pawl shall engage the teeth of the tumblers, and hold them stationary. Also, operating the slides, the bolt, and the pawl, directly from the wrench shaft."

96. For an *Improved Method of Adjusting Round Tenon Cutters to certain Fixed Sizes;* Melyn Weatherington, Springfield, Ohio.

Claim.—"The combined use of the uncut counter sunk disk and removable rings, and the bit adjustable thereto, for the purpose of making an adjustable hollow auger capable of boring tenons of various sizes without splitting or dividing the stock."

97. For an *Improvement in Governors of Steam Engines, &c.;* A. F. Ward, Louisville, Kentucky.

"This invention consists in the arrangement and employment of a double armed screw socket, clutch, and friction socket."

Claim.—"The arrangement of the friction socket, the female screw socket, with its arms, and the clutch on the governor rod; the whole combining to operate so that the female screw socket may be prevented turning till the full supply of steam is given, or till the steam is cut off entirely, and afterwards be caused to turn with the governor rod."

98. For an *Improvement in Bureau Bedsteads;* Ethan Whitney, Boston, Mass.

Claim.—"My improved manufacture of bureau bedstead, viz: with the bedstead portion made in two parts hinged together, and applied to the case by projections and grooves, in order that the said bedstead may be either folded together and slid back into the case, or be drawn forwards and out of the case, and unfolded or let down into a horizontal position, as circumstances may require."

99. For an *Improvement in Machines for Cleaning Cotton;* Lewis S. Chichester, Assignor to Henry G. Evans, City of New York.

Claim.—"The combination of the spring bars, one or more series, the hopper, rotating picker or arms, shake screens, and deflecting screens."

100. For an *Improvement in Pumps;* Birdsill Holly, Assignor to Silsby, Mynderse, & Shoemaker, Seneca Falls, New York.

"This invention relates to certain improvements in lifting pumps, and consists in the peculiar means employed for allowing, when necessary, the waste or surplus water to escape from the cylinder."

Claim.—"The leather placed over the perforations in the top of the vase, and the chamber which is placed on the leather, said leather being provided with a flanch provided with holes, either of which is fitted on the pin for the purpose of exposing or closing the passage."

101. For an *Improvement in Cultivators;* Henry Schreiner, Jr., Assignor to self and George Lark, Berrysburg, Pennsylvania.

Claim.—"In connexion with the cultivator, the arrangement of the cross beams and the transverse beam."

102. For an *Improved Lubricator;* Henry J. Hawkins, Mobile, Alabama.

Claim.—"The general arrangement of this lubricator with its mode and manner of admitting the lubricating substances, so as to strike at once on all parts of the interior surface of the cylinder."

103. For an *Improved Mode of Cutting Tenons by two Circular Saws oblique to Shaft;* Wm. H. Harrison, Philadelphia, Pennsylvania.

Claim.—"The use of two circular saws upon the same shaft, when their planes form an acute angle with each other, and made adjustable on their shaft."

104. For an *Improvement in Railroad Car Seats;* Bernard J. La Mothe, City of New York.

Claim.—"Constructing seats with elliptical springs at the sides, receiving the cushions on the upper part of said springs, when combined with the friction rollers, or their equivalents, whereby a lateral motion is allowed to said seat. Also, constructing the back of the seat by an enclosing frame formed of the double bent rod, with eyes at both ends, through which eyes, and between the bends of which rod, the sustaining pipe or rod passes."

JULY 21.

105. For an *Improvement in Inking Rollers for Printing Presses;* E. E. Barrett, Chicago, Illinois.

"My improvement consists in the use of a hollow inking roller, perforated with a number of holes, through which the ink oozes, saturating the material with which it is cased for the purpose of inking the type, thus constituting a fountain or self-feeding inking roller."

Claim.—"Saturating or coating the inking roller of a printing press with ink."

106. For an *Improvement in Feed Motion for Sewing Machines;* Abraham Bartholf, City of New York.

"This invention relates to the rotary or wheel feed, and consists in certain novel, simple, and effective means of producing and controlling the movement of the feeding wheel."

Claim.—"1st, Giving the necessary motion to the feeding wheel through the agency of a collar, or its equivalent, which by being turned in one direction around a central shaft fitted loosely in said wheel, is caused to move longitudinally on the said shaft towards the wheel, and thus clamp the wheel in one direction parallel with the length of the shaft against a flanch, or its equivalent, fast on the shaft, and thus to carry with it both the shaft and wheel in a circular direction, but which on being turned in the reverse direction is caused to move in the reverse direction parallel with the shaft, and thus to liberate the shaft from the feed wheel, and allow it to return without the said wheel. 2d, The attachment rigidly to the loose feed wheel shaft of a lever, or its equivalent, so operated by a cam, or its equivalent, that when the loose clamping collar, or its equivalent, is allowed to return after having given motion to the shaft and feed wheel together, the shaft is temporarily prevented returning with the clamping collar, or equivalent, and thus the friction between the wheel and the fast flanch or projection against which the wheel has been clamped by the clamping collar, is made to aid in preventing the return of the wheel with the loose clamping collar, or its equivalent."

107. For an *Improved Arrangement of Camels for Raising Sunken Vessels;* Thomas Bell, City of New York; patented in England, April 16, 1856.

Claim.—"The arrangement of camels whereby great strength is secured to support a vessel while being raised and transported, and whereby the vessel will be lifted principally by the bow and stern, or where the greatest strength exists, and only partially fore and aft or where the least strength exists; and whereby all the inconveniences attending the application and use of those devices which require that some of their parts shall be passed under the keel, or over or through the vessel, are avoided, and the numerous benefits secured."

108. For an *Improvement in Machines for Planting Potatoes;* Galusha J. Bundy, Lyndon, Vermont.

Claim.—"The arrangement of the two movable gates, with the slider, the seed and fertilizer hoppers, and their discharging holes or chambers."

109. For an *Improvement in Machines for Manufacturing Felt Cloth;* Thomas B. Butler, Norwalk, Connecticut.

Claim.—"The traversing of the bat apron by traversing the apron drum independently, and in connexion with a traverse of the frame. Also, the traverse of the apron, in combination with a simultaneous opposite traverse of the transfer roll."

110. For an *Improved Sawing Mill;* William M. Ferry, Jr., Ferrysburg, Michigan.

Claim.—"1st, Arranging the saw arbor and all the parts bearing a close relation to the saw on a metal yoke, and making said yoke capable of being adjusted so as to stand slightly out of parallel with the edge of the carriage. 2d, Constructing the saw spindle with circular flanch, and the common saw collar which surrounds the eye of the saw with a T shaped socket of greater length than the flanch, so that the saw may have slight end play independent of bearings, spindle, or gearing. 3d, The application of the adjustable self-fastening trip to a saw mill, which operates with a continuous rapid motion back and forth for operation, in combination with the vibrating reversing stop."

111. For an *Improved Apparatus for Making Acid Sulphate of Lime;* Laurent Gaumotis and Sabin Martin, New Orleans, Louisiana.

Claim.—"The process of making bi-sulphate of lime by means of furnace and cisterns."

112. For an *Improvement in Rotating Harrows;* James B. Gascock, Fancy Creek, Illinois.

Claim.—"Causing the after end of the pivoted draft bar to bear upon the upper surface of the rotating tooth frame, in such a manner as to properly distribute the propelling power exerted upon said draft bar, by which I relieve the fulcrum journal from injurious warping strains, and at the same time impart a steady and uniform movement to said tooth frame as it is drawn forward."

113. For an *Improvement in Corn Harvesters;* G. D. Haworth, Mechanicsburg, Ill.

Claim.—"The cutters attached to suspended rods, the cutters curved and working underneath stationary teeth or fingers."

114. For an *Improvement in Feed Rollers of Planing Machines, &c.;* Jonathan Hall, Worcester, Massachusetts.

Claim.—"The application and use of internal gearing. Also, in combination therewith the arrangement of the movable box and connecting bridle, or their equivalent."

115. For an *Improved Arrangement of Means for Regulating the Fire of Coal Burning Locomotives;* John M. Hartnett, Wawkegan, Illinois.

Claim.—"The fan placed within the box connected with the pipes provided with valves."

116. For an *Improvement in Tension Apparatus for Sewing Machines;* Abraham Hoagland, Jersey City, New Jersey.

Claim.—"The use of two elastic wheels or rollers (governed by the saddle and thumb screw), between and around which the thread is passed to give it any required tension in sewing."

117. For an *Improvement in Signal or Alarm Bells;* George H. Hoagland, Port Jervis, New York.

Claim.—"The use of the reel, for the purpose of striking the bell for a signal, or ringing continuously for alarm. Also, the combination of the reel with the hammer and belt."

118. For an *Improvement in Shovel, Spade, or Dung-fork Handles;* George C. Howard, Hardwick, Massachusetts.

Claim.—"My improved manufacture of shovel handle as made with a split and bent stock, and a round holder applied and fixed together by concavities in the ends of the holder, convexities on the arms of the eye, and a rod and metallic caps arranged and fixed together."

119. For an *Improved Metallic Bridge for Piano-Fortes;* G. Henry Hulskamp, Troy, New York.

Claim.—"1st, The sounding board bridge cast of metal, with two bearings above

the string, one on each side of the bottom support. 2d, The rod or wire, or its equivalent, inserted in the bridge to form its bearing surface. 3d, The construction and arrangement of the cast metal bridge, in such form that it may be detached and yet firmly held in its place."

120. For an *Improvement in Hog Troughs;* Elmore Johnson, Winchester, Mass.

Claim.—"An elongated trough or bowl and a quadrantal cover, arranged or applied together, and an opening in a frame, wall, or the side of a pen or sty."

121. For an *Improved Sawing Mill;* Franklin B. Kendall, Bath, Maine.

Claim.—"The general arrangement thereof."

122. For an *Improvement in Corn Planters;* Norman A. Lewis, Glenn's Falls, New York.

Claim.—"Having the slides placed over the ends or orifices of the conveying tubes, the slides being attached to the ends of the same rod, and operating said rod by means of the curved incline attached to the rod or bar, and the pulley or roller attached to the rod, whereby the slides are actuated or opened and closed alternately. Further, the hoe attached to the frame which is placed within the roller frame, arranged and operated by the projections on the driving-wheel."

123. For an *Improvement in Bagasse Furnaces;* George M. Longacre, New Orleans, Louisiana.

Claim.—"The construction of bagasse furnaces with a space around and communicating with the upper portion of the fuel chamber, and leading to an exit flue, regulated by a damper, when said parts are additional to the ordinary channels for the passage of the products of combustion."

124. For an *Improved Hand Wrench;* George B. Phillips, Albany, New York.

Claim.—"In combination with the jaws the arrangement for regulating the space between the jaws, and securing them when so adjusted, that is to say, by the employment of toothed blocks operated alternately upon teeth in the upper jaw by the spring and saddle, or their equivalents, so as to regulate the space to distances differing by half the spaces between the teeth."

125. For an *Improvement in Railroad Car Couplings;* Wellington Prosser, Kendall, New York.

Claim.—"The combination of the jaws, hoop, or band, and link or shackle bar. It being understood that I do not claim the combination of the jaws with the link alone, but the combination of these two elements with the band."

126. For an *Improved Method of Turning Carriage Hubs;* Alexander Rickart, Schoharie, New York.

Claim.—"The frame placed on the driving or power shaft, and connected with the mandrel by the arms, the frame being provided with the gearing to connect the shaft with the mandrel, which mandrel is placed on the sliding carriage, when the above parts are used in connexion with the rotating cutter head."

127. For an *Improvement in Governor for Water, Steam, and other power;* Nathan Scholfield, Norwich, Connecticut.

Claim.—"The application of a compensating adjustment for so changing the normal or medium rate of action of a governor or regulator while in action, to rectify a disturbed motion, that it shall cease to act on the supply of the motive power while the speed of the wheel or machinery is returning from any extreme of variation, and before reaching its proper rate or that in which its action commenced; and also that it may commence a reverse action thereon, to counteract or anticipate any excess thereof, if the return of the speed is so rapid as to induce a tendency to pass its proper medium."

128. For an *Improvement in Garden Hoes;* Solomon Shetter, Allegheny, Penna.

Claim.—"Cutting and forming hoe blades out of sheet iron or steel with side edges and prongs."

129. For an *Improvement in Cotton and Cane Cultivators;* Thomas E. Shannon, Woodville, Mississippi.

Claim.—"The combination with the wheel carriage of a series or gang of revolving cultivators."

130. For an *Improvement in Straw Cutters;* Jonathan L. Sullivan, Lexington, North Carolina.

Claim.—"The two sets of knives and slotted plate, combined and arranged so as to operate conjointly."

131. For an *Improvement in Roofing Compositions;* John B. Wands, Chicago, Ill.

Claim.—"The combination of the various ingredients."

132. For an *Improvement in Means of Stopping Shot Holes in Vessels;* John Woodville, Chillicothe, Ohio.

"This invention consists in the arrangement of the means for stopping the shot holes in vessels of war."

Claim.—"1st, The arrangement of the disk formed of india rubber and whalebone slats, the rigid bar, the jointed rod, the chains or cords, and the springs, relatively to one another. 2d, The arrangement on the bar of the slide, the tubular rod, the slide, with catch, the rod, and the straps, relatively to one another, and to the disk and its attachments."

133. For an *Improvement in Grain Separators;* William Zimmerman, Quincy, Ill.

Claim.—"The perforated rotating disk with its diamond-shaped ring, or its equivalent, on the same shaft with the fan, arranged and operated so as to throw the grain by centrifugal force into the blast pipe horizontally. Also, the cheat box around the suction pipe, in combination with the tunnel-shaped delivering tube and spreader, so as to make the grain descend through the blast of air, and through a tunnel-shaped pipe over the spreader. Also, a conical plug arranged so that it can be adjusted in the suction pipe, to graduate the flow of the blast in the suction pipe, and regulate it as desired."

134. For an *Improvement in Retort Covers;* James R. Floyd, Assignor to Theodore C. Kibbe, City of New York.

Claim.—"The constructing gas retort covers of malleable iron."

135. For an *Improved Means for Rendering Joints Steam-tight;* William S. Gale, Assignor to Peter Pillon, City of New York.

"This invention consists of a grooved or corrugated surface with an opposing smooth or plane surface."

Claim.—"The method of causing steam to become a packing to itself in steam cylinders, or other parts of steam machinery, by allowing the steam to act in one or more grooves."

136. For an *Improvement in Machines for Digging Potatoes;* Joseph Heulings, Assignor to self, W. H. Lawson, and B. M. Heulings, Philadelphia, Pennsylvania.

Claim.—"The combination of the rotary diggers, oscillating frame, and oblique stalk cutter."

137. For an *Improvement in Diaper Pins;* J. Heilman, Assignor to Ignatius Sturn, City of New York.

Claim.—"The tube, having the slide fitted within it, the slide being attached to one end of the tube by a spring formed of india rubber, or other suitable material, and the hook attached to the slide, the tube being slotted longitudinally."

138. For an *Improvement in Photography;* Henry A., Assignor to Edward D. Marchant, Philadelphia, Pennsylvania.

Claim.—"The rendering of the picture transparent, and attaching the same to glass in a permanent and secure manner, by means of a mixture applied under heat and pressure."

139. For an *Improvement in Spark Arresters;* John F. Page, Assignor to self and James Landy, Philadelphia, Pennsylvania.

Claim.—"The arrangement of parts relatively to one another, so as to effectually arrest the sparks of a locomotive without obstructing the draft."

140. For an *Improvement in Cylindrical Door Bolts;* Charles G. Page, Washington, D. C.

Claim.—"The oblique slot in the guard, in combination with the lever or handle of

the bolt working in said slot. Also, the zigzag or return slots in the guard, by which the bolt is carried through its range by the two movements of raising and depressing the handle."

JULY 28.

141. For an *Improved Feeding Arrangement for Sawing Machines;* Thomas J. Alexander, Westerville, Ohio.

Claim.—"The combination and arrangement with a reciprocating feed carriage as a means of operating the same, to effect the reciprocating travel or feed by propelling gear therein, or connected therewith, operated by or from a main feed shaft of the freely sliding or self-adjusting pulley frame, with its right and left hand belts driven and communicating motion to the main feed shaft."

142. For an *Improved Method of Driving Circular Saws;* Thomas J. Alexander, Westerville, Ohio.

Claim.—"The combination and arrangement with a revolving saw or cutter, having either a fixed or reciprocating relationship or action in the path of its cut, of the freely sliding or self-adjusting loose pulley carrying frame, made whole or divided and rigid or self-stretching, with its loose pulleys, right and left hand belts and pulleys, of the saw and counter shafts."

143. For an *Improvement in Governors for Regulating the Work of Wind-Mills, &c.;* Ethan Allen, Worcester, Massachusetts.

Claim.—"In combination with the adjustable or expanding crank, the projection attached to the slide of the crank pin, the sliding rod upon which it acts, for the purpose of engaging a grooved collar upon the spindle of the governor, whereby its adjusting power is confined within a certain proper range."

144. For an *Improved Fuse-making Machine;* Albert F. Andrews, Aron, Conn.

Claim.—"1st, The admission of a blast of compressed air upon, into, among, or through the powder on its way through the passage or channel, by which it is conveyed to the fuse. 2d, Giving the feeding tube a rotary motion outside of a conducting tube, and inside a laying piece, both of which are stationary."

145. For an *Improvement in Segmental Truss for Bridges, &c.;* George S. Avery, Lewisboro', New York.

Claim.—"An improvement in segmental truss bridges, by a combination of the arched top chord, horizontal bottom chord, braces, vertical tie rods, packing blocks, and self-adjusting shoes, the whole constructed into a segmental truss of greater strength and stability than such as are generally used with the same amount of building material. Also, the combined arrangement of the different parts."

146. For an *Improvement in Pill Machines;* James C. Ayer, Lowell, Massachusetts.

Claim.—"The corrugated or grooved globule cylinders, or their equivalents, for forming the rods of 'mass' or semi-solid material into globules. Also, the cylinder plunger and screw, for forming the round rods of the desired size. Also, the knife, or its equivalent, for cutting the rods of semi-solid substance the desired length, so arranged that it will cut or sever the rods without its sticking to them."

147. For an *Improved Automatic Lathe for Turning Irregular Forms;* Samuel N. Baker, New Haven, Connecticut.

"This invention relates to the use of a series of cutters attached to a moving head, operated and moved to form the configurations upon the article being turned in the lathe, to which the head is attached by revolving the pattern dies against the cutters, or by revolving the cutters against the pattern dies, and giving to the head containing the cutters a motion in the line of the length of the article being turned, for the purpose of giving to the article the required shape through the combined movement of the head and the cutters."

Claim.—"1st, The use of a series of cutters secured to a cutting head, standing at right angles to the article being turned, the said cutters being operated by being revolved within the circular case. 2d, The use of a pattern guide or die, or a series of them, placed at right angles to the article being turned, within a circle struck from the 'centre' of the lathe, and having a movement in the direction of the length of the lathe coinci-

dent with that of the cutters, and against which the cutters in their revolution come in contact. 3d, The use of a sliding cutter head containing both the cutters, to perform the operation of turning, and the pattern dies or guides to control the movements of the cutters."

148. For an *Improvement in Tanning Compositions;* Ira Carle, Kingston Township, Pennsylvania.

Claim.—"The use of hemlock or oak bark, nitric acid, and Glauber's salts, all to be used in one bath for the purpose of tanning leather from hides in a short space of time."

149. For an *Improved Auger Handle Fastening;* William N. Clark, Chester, Conn.

Claim.—"The attachment of the nut to the handle of the auger, for the purpose of preventing the parts from being lost, and to form a secure and convenient fastening."

150. For an *Improvement in Smut Machines;* Everard M. Clark, Lancaster, Penna.

Claim.—"The shape and construction of the fluted propeller, for the purpose of scouring the grain, at the same time driving a blast upwards, so as to blow off the cheat, smut, &c., out of the spout above, before the grain passes down on to the wings of the propeller and concave."

151. For an *Improvement in Adjustments applied to Pendulum Levels;* Calvin Cole, Tarrytown, New York.

Claim.—"1st, The adjusting platform with its attached set screw and spring. 2d, The adjustment of the dial plate around the axis of the pendulum by the set-screws."

152. For an *Improvement in Artificial Legs;* R. H. Nicholas and Douglass Bly, Rochester, New York.

Claim.—"The use of the ball, the two sections of the limb being held together."

153. For an *Improved Method of Sawing Staves from the Bolt, and Dressing their Edges simultaneously;* Elisha K. Collins, Cambridge, Mass.

Claim.—"The band saw or saws, endless chain, which gives a continuous feed motion to one or more beds or plates attached, curved bars, the rotating cutters, the racks and the gearing, and screws connected with the bar, when they are arranged and combined to operate conjointly for the purpose of sawing, jointing, and dressing staves at one operation."

154. For an *Improved Machine for Tempering Scythes;* C. P. Crossman, Warren, Massachusetts.

Claim.—"The employment within a suitable water tank of a pair of movable jaws and boxes, for the purpose of seizing, holding, and conveying the scythe blade."

155. For an *Improved Shell-roller Bed for Planing Machines;* George Darby and James E. Young, Augusta, Maine.

Claim.—"The combination of the hollow or shell-rollers with the bevel grooved rollers, whereby a bevel grooved or straight bed is formed."

156. For an *Improved Machine for Seaming Sheet Metal Roofs;* Lucian Fay, Cincinnati, Ohio.

Claim.—"The use of the burning, folding, and seaming rollers, constructed with or without adjustable elastic bearings, in connexion with the movable platform or carriage."

157. For an *Improvement in Spark Arresters;* Henry H. Graham, Paterson, New Jersey.

Claim.—"Placing the slats in the vertical sides of the radial spark conductors at a higher elevation than the screens connecting the bases of said conductors, and with the mouths between said slats opening toward the angle between said spark conductors, and in the opposite direction to the accelerated motion of the products of combustion."

158. For an *Improved Machine for Punching and Shaping Metals;* George Haseltine, Washington, D. C.

"This invention consists in the employment of dies and punches, so arranged and operated that the required metal is cut from the bar or rod, shaped and punched, without waste of material, and the completed article discharged from the die box at every revolution of the shaft."

Claim.—"1st, The punch in connexion with the punch. 2d, The movable dies when used in combination with two punches."

159. For an *Improvement in Mop Heads;* James S. Harris, East Poultney, N. Y.

Claim.—"Constructing the wire jaws so as to nearly or quite inclose oblong spaces, for the purpose of more effectually embracing and holding the cloth. Also, the pin when used in combination with the jaws."

160. For an *Improved Mortising Chisel;* Christian J. Heistand, Rapho, Penna.

"This invention consists in providing the chisel with an eye, for the reception of a long handle."

Claim.—"The new article of manufacture consisting of a chisel with a handle placed at right angles with the cutting part."

CIVIL ENGINEERING.*

For the Journal of the Franklin Institute.

Improvement of the Ohio River. By CHARLES ELLET, Jr., Civ. Eng.

I have no wish to participate in the discussion now going on in the pages of the *Journal*, of the merits and faults of the various suggestions for the improvement of the navigation of the Ohio River. My object, at this time, is merely to invite the attention of Mr. W. Milnor Roberts to an error in his communication in the September number of the *Journal*, which, when corrected, I think will cause him to withdraw his modification of the plan of "Low dams with open sluice ways."

Mr. Roberts seems already to have condemned Mr. Haupt's plan of low dams with canals along shore; which, indeed, Mr. Morris had previously shown to be entirely impracticable. If, then, it shall appear that Mr. Roberts's modification of that plan is equally impracticable, the investigation in which he is now most laudably engaged, will be narrowed down to its former dimensions—to a choice between the system of reservoirs, and the system of locks and dams.

There will then be no other plans before the public at all worthy of consideration.

Mr. Roberts's recent plan of using reservoirs, along with low dams and open sluices, is devised expressly for the purpose of saving water—*in the supposition that a river can be made to stand on an inclined plane without being fed with the supply of water due to the slope of the plane, its depth and the length of its wetted perimeter.* This is an oversight, fatal to his modification.

The expectations of Mr. Roberts would be *approximately* satisfied, if his low dams were placed along at spaces of about a quarter of a mile, instead of every *seven miles* of the river's course.

I do not wish to enter into any detailed investigation of this problem. I am satisfied that it is only necessary to call Mr. Roberts's attention to the point, to insure a new and more correct view of the subject. He will perceive, I am sure, as soon as his mind is again brought to the question, that he cannot obtain a depth of six feet between his dams, when placed from eleven to fifteen miles apart, as he proposes, unless he provides almost the precise quantity of water that would be required to maintain a depth of six feet in the natural and unobstructed channel of the river. The only object of the 80 dams proposed by Mr. Roberts,

* The two following articles were received too late to be put in the position of this number devoted to Civil Engineering.—ED.

is to save water. But they are to be set too far apart, and will not save any ; or if any, only a quantity inappreciably small.

I am confident that Mr. Roberts will take great pleasure in correcting this error, which is obviously an oversight, and adapting his interesting paper to a sounder view of that part of his subject. This correction will materially simplify the great problem he has on hand ; freeing his own mind and the channel of the Ohio at the same time, from the prospective incumbrance of 75 or 80 unnecessary dams. He will then have nothing to do but to get rid, also, of an equal number of unnecessary locks, and his path to a correct solution will be clear and easy.

For the Journal of the Franklin Institute.

Jordan Iron Bridge near Allentown, Pennsylvania.

By Ellwood Morris, Civ. Eng.

The railroad extending into the interior from the Crane Iron Works, at Catasaqua, for the conveyance of iron ore from various beds in Lehigh county, Pennsylvania—crosses the Jordan creek where the valley is nearly a quarter of a mile in width at grade, and about 1060 feet at the bottom.

The grade level at this crossing is nearly 90 feet high, above low water in the Jordan, and its valley formed a very serious obstacle to encounter upon a merely local railroad.

Proposals for an iron bridge were finally invited by the Company, and the contract assigned to F. C. Lowthrop, Esq., a civil engineer of great experience and skill.

The extreme length of the bridge is 1165 feet, and the iron superstructure consists of 11 spans, of 100 feet each. These spans are of a suspension truss, each truss being 16 feet high, and the two trusses, necessary to carry a single track railroad, being spaced 10 feet clear apart.

The trusses are supported upon a group of cast iron pillars, of cruciform section, connected and braced together in stages, and firmly stayed laterally by heavy wrought iron bracing rods bolted to the masonry.

These skeleton piers of cast and wrought iron, stand upon low piers of solid masonry, raised above the line of flood, and pointed at both ends.

The single track railway crosses upon the deck of the iron bridge, in a continuous straight line.

Early in July, this bridge—which is believed to be the longest iron structure yet erected in the United States, was tested to the entire satisfaction of the Company, with a loaded train drawn by a locomotive—the whole train weighing upon each span of 100 feet = 113 tons, *or more than one ton to the foot lineal, which was the test load contracted for.*

This bridge is now in use, and attracts crowds of visitors. It presents a very light and graceful appearance.

The first stone was laid August 27th, 1856, and the first locomotive crossed July 14th, 1857, the whole having been completed in less than a year.

This is in every sense a remarkable work, and does the highest credit to the energy and ability of the engineer and contractor, F. C. Lowthrop, Esq.

The small cost at which this wide and deep valley has been crossed by Mr. Lowthrop, will surprise many of our engineers, as much as the very short time required for its construction.

The entire cost has been less than $70 per foot run, or about $70,000 for the entire structure!

This structure demonstrates conclusively the speed and economy with which iron bridges may be erected for railway purposes, and will do much to extend their use in our country.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On Soluble Glass, its Preparation and Applications.**

By J. N. von Fuchs.

(Continued from page 199.)

Undoubtedly one of the most useful applications of soluble glass is to painting, as it it is peculiarly fitted to fix colors well, and also to give great permanence to all coatings. This mode of painting is called *stereochromy* by the author; and under this term he understands those methods of painting in which soluble glass constitutes the medium for fixing the colors and their supports, in which respect stereochromy is essentially distinguished from all other kinds of painting.

In monumental painting it competes with fresco-painting, and will undoubtedly supersede it, and even attain a wider field of application. In Prussia, fresco-painting has already been given up to a great extent, and the wall-pictures in progress there are being executed by the stereochromic process. In England, also, this method has met with great acceptance. The so-called encaustic painting cannot compare with it.

The author was first led to the idea of employing soluble glass in painting by the numerous complaints of the imperfections of fresco-painting, and the general opinion that frescoes would not last in our climate. He met with great difficulties in effecting the application of soluble glass to this kind of painting, and only succeeded when he united himself with Von Kaulbach for this purpose.

Wall or Monumental-painting upon a Mortar-ground.—When a stereochromic picture is to be applied in a beautiful and permanent manner to a wall, especial care must be devoted to the material to which the work of art is to be applied, that is, to the mortar, the substratum, and the superstratum. Errors made in this may render the painting difficult, and injure the beauty of the pictures. In this, the principal problem is to give the ground an equal stony solidity throughout, and as it were to amalgamate it with the wall, but at the same time to manage that it imbibes the soluble glass well and uniformly in all parts. The first coat, or substratum, is made with ordinary lime-mortar, so as to do away with

* From the Lond. Chem. Gaz., No. 348.

the inequalities of the wall, and cover the stone well. The sand in this should be of a medium size, neither too coarse nor too fine; it is, however, of little consequence whether it be calcareous or quartz-sand, but either must be well washed before use. The properly slaked lime must be sparingly employed, in order that the mortar, which is to be made with distilled or rain-water, may be rather poor than fat. If the mortar were too fat, the soluble glass would penetrate with difficulty.

The plaster thus prepared must not only be allowed to dry well, but must also remain exposed for several days to the air, in order that it may attract carbonic acid and become converted into subcarbonate of lime; for if the lime in this mortar were still caustic, the soluble glass would be decomposed by it, and could not penetrate into the wall, which is extremely necessary if a good binding is to be effected by it.

To facilitate the impregnation of the lime with carbonic acid, a solution of carbonate of ammonia may be employed, by which the mortar acquires a greater solidity when it has been moistened with it two or three times. When it has again become quite dry and the ammonia has evaporated, the soluble glass is employed to fix it and attach it firmly to the wall; with this it is to be well soaked repeatedly, drying between each application, until it is almost saturated. The soluble glass employed for this purpose should be soda or double water glass, mixed with so much solution of silicate of soda that it may be quite clear, and not opalescent.

Soda-glass or double water-glass is to be preferred to potash water-glass, because it is absorbed better. It is not to be employed in a concentrated state, but diluted with an equal volume of water, as otherwise there is a probability that it would not penetrate into the wall. As the plaster cannot be equally thick in all parts on account of the inequalities of the wall, and the thicker parts require more soluble glass than the thinner, and consequently continue to absorb it when the latter are already saturated, the thick parts must be sought out with a moist brush, and soaked with soluble glass until they are saturated.

When the substratum is fixed in this way, the superstratum, which is to receive the picture, may soon afterwards be applied. As already stated, much depends on this being of the proper nature, if the desired object is to be attained with certainty and without difficulty.

For this purpose, the superstratum, which does not differ essentially from the substratum, should be prepared with distilled or rain-water and well-washed sand (calcareous or quartz-sand), of a particular grain, not exceeding a certain size, and kept rather poor, in order that it may not form any cracks and may be able to absorb readily. To get the sand of the proper grain, it must be passed through a sieve, such as is known in Munich as No. 9, and the meshes of which measure five Rhenish points in width.

As regards the quality of the calcareous sand, that which is artificially obtained by pounding marble or dolomite is to be preferred to natural sand, because the latter consists of roundish, and as it were ground grains, which do not bind so well as the sharper granules of the artificial calcareous sand, which possess a fresh and rough surface. The very fine powder, which is however advantageous for good binding, must be got

rid of either by lixiviation or by a fine sieve, as otherwise the mass would be rendered too compact and no longer thoroughly absorbent.

The texture of the surface of the painting ground depends principally on the size of the grains of sand; the coarser these are, the rougher will it turn out, which to a certain extent is favorable to the painting so long as the colors, which are to be applied merely with water, adhere sufficiently until the application of the soluble glass.

The surface should never be smooth or ground, because then it receives but little or none of the color without fixing media. As Von Kaulbach expresses himself, the surface must feel like a file. A distinction must also be made between pictures which are to be seen closely and those which are to be viewed from a distance; in the latter the grain of the surface may be considerably coarser than in the former, for which rather finer sand should be used.

This ground or mortar is applied as evenly as possible to the thickness of about a line upon the substratum; and when it has become dry, it is rubbed with a sharp sandstone (or, as in Berlin, with an iron ruler), in order to give the surface the proper roughness, and at the same time to remove the thin stratum of carbonate of lime formed during desiccation, which would prevent the absorption of the soluble glass.

The author, however, considers it far better to destroy the incrustation by a simple chemical agent, namely, dilute phosphoric acid (1 part of concentrated acid to 6 parts of water). A sponge soaked with this fluid, or a brush moistened with it, passed over the surface, does all that is necessary. As the phosphate of lime thus produced, binds well with soluble glass, no injury is done to the mortar thereby, and at the same time we avoid the starting of small fragments, which may take place during the mechanical rubbing, forming small holes, which require to be repaired.

When the ground is so far prepared and well dried, it is impregnated with soluble glass, in order to give it the necessary consistency and amalgamate it properly with the substratum. For this purpose, double soluble glass, rendered clear by silicate of soda and diluted with an equal quantity of water, may be employed with advantage. It will generally be sufficient to perform this operation twice, drying the mass after each application, for it must be done in moderation in order that the pores may not be closed by too much soluble glass, by which the difficulty of the painting would be considerably increased. If a mistake has been committed in this respect, the ill effects can only be got over, either by removing the mortar, or by waiting for a time before commencing the painting, until by the further contraction of the soluble glass the ground opens again of itself. This will be greatly facilitated by heat, which is most easily applied by burning spirit of wine upon the ground.

After the superstratum has been prepared either by friction or phosphoric acid, and fixed with double soluble glass, to which a little silicate of soda has been added in such a way that this has been uniformly diffused over its surface, and the ground has proved to be uniformly and thoroughly absorbent, the painting may be commenced. There is, however, no occasion to hurry with this; on the contrary, it is even well to wait for a time, because in the meanwhile the ground becomes drier, and thus the faculty of absorbing, which is absolutely necessary for the painting, is increased.

The colors are applied with pure water; and the wall is frequently syringed with pure water, in order to expel the air from its pores and assist the adhesion of the colors. This syringing, however, should be moderate, and no more than is necessary, and the greatest possible care should be taken that the neighboring parts, which are already painted, may not receive too much of it, because otherwise, as Echter remarks, the colors would lose somewhat in brilliancy; the reason of which apparently is, that by the application of too much water the finest and weakest coloring particles are washed up on the surface, and thus separated from the other more powerful ones. This undesirable result occurs especially on those places which are repeatedly painted over, and for this purpose require to be moistened. Echter, however, has found a means of entirely getting rid of this inconvenience, by brushing off these dull coloring particles, after drying and before fixation, by means of a very fine brush, after which the colors again make their appearance in their original purity.

Nothing more is then necessary than to fix the colors properly, for which purpose the soluble glass for fixing has already been indicated (at p. 123) as peculiarly applicable. It is sufficient to dilute it with one-half of water.

As, however, the colors only adhere weakly, and do not allow of the use of the brush, the soluble glass must be syringed upon them in the form of a very fine rain or cloud, and at first very cautiously, in order that the colors may not be removed from their places and run together. For this purpose, Prof. Schlotthauer, who has occupied himself much with stereochromic experiments, has invented a syringe which scarcely leaves any thing to be desired. This operation is continued, with intervals of drying, until the colors adhere so firmly that they communicate nothing to the fingers when passed over them. When white pocket-handkerchiefs, which are sometimes used for this purpose, are dirtied by strong friction, this proves nothing against the permanence of the colors, because when rubbed with a strong pressure, grains of sand are loosened, and these attack the colors, which, however, the pocket-handkerchiefs cannot do of themselves. The same thing may also be observed in fresco-paintings.

In testing the colors as to their permanence and fixity, it is sometimes found that whilst some of them are sufficiently fixed, others still appear to be more or less loose, and dirty the fingers. To these belong the so-called meagre colors, such as black. These require still more soluble glass, which must be applied to them by means of a fine pencil, until they adhere as firmly as the others. Von Kaulbach, however, has very recently stated that this occurs very rarely, as it may be obviated by a proper mixture of the colors.

This is essentially the process by which Von Kaulbach, assisted by Echter, has executed four large stereochromic pictures in the new Royal Museum at Berlin, as to the excellence of which, especially the last, there is but one opinion.—*Abhandl. der Naturw. Commission bei der Konigl. Akad. der Wiss. zu München;* Dingler's *Polyt. Journ.* cxlii. p. 365.

Specification of a Patent granted to JOHN RAMSBOTTOM *and* JOHN CHARLES DICKINSON, *for improvements in machinery or apparatus for measuring and registering water and other fluids, and obtaining motive power from the same.*—[Dated 30th November, 1855.]*

This invention consists principally in an improved method of regulating the passage of water to and from the measuring chambers of water metres, in such a manner, as to obtain an uniform supply and delivery, without the shock and concussion attendant upon rapid valvular changes: therefore, the structure, arrangement, and mode of actuating the valves, constitute the principal features of this invention, in connexion with certain measuring chambers, crossed by diaphragms of india-rubber, gutta-percha, metal, or other suitable flexible substance or material, so as to divide each of the chambers into two, in order that the fluid entering one chamber may press the flexible diaphragm against the side of the other chamber, and besides discharging the fluid from the latter chamber, give motion to the valve and registering apparatus by means of rods, one of which is attached to each diaphragm, and which passing through the chambers, are provided with suitable appendages to effect this motion.

Fig. 1, is a sectional elevation of one form of the apparatus. *a*, *b*, and *c*, *d*, are chambers; *e*, the diaphragms; *f*, the diaphragm rods; *g*, the cranks; *h*, the shaft; *j*, the wheels communicating with the valve *k*, and *l*, the vertical spindle, worked by the spiral screw *m*, which moves the registering apparatus contained in the box *n*. *o*, are supports for the shaft *h*. Fig. 2, shows the valve-seating, with apertures corresponding to the number of chambers; and fig. 3, the valve, which in this case, has six apertures,—three of which, o^1, o^1, o^1, are connected with the supply-pipe, and alternately constitute the feedways leading to the chambers. The other three apertures *p*, *p*, *p*, are connected alternately with the chambers, and serve as the discharge apertures therefrom, into the body of the metre *q*, from whence the fluid is withdrawn by the outlet pipe *r*. These valves may either feed and deliver at the bottom or at the sides, similarly to the one next described. Fig. 4 is a horizontal cross section of this valve, but having two apertures only; o^2 being the supply, and *p*, the delivery, shown in connexion with its seating and passages. To cause this valve to be similar in effect to a valve of six apertures, it must make three times the number of revolutions. It will be readily seen that when rotary motion is imparted to these valves, the feed and exit ways change suc-

Fig. 1.

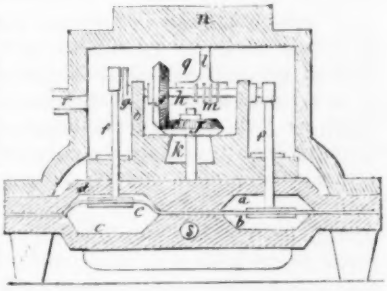


fig 3

fig 4

fig 2

* From Newton's Lond. Journ., January, 1857.

cessively,—the diminishing supply and exit in one set of chambers being accompanied with increasing supply and delivery in another set of chambers.

Fig. 5.

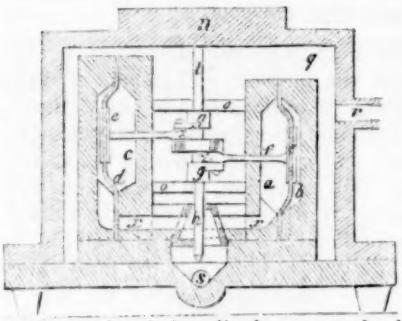


Fig. 5 exhibits another arrangement of this principle, in which chambers and diaphragms are situated perpendicularly, with the horizontal rods standing opposite to each other when two are used, and at right angles should four diaphragms be preferred. The motion in either of the above forms of apparatus may be communicated directly to the cranks by slotted cross-heads z, being fixed to the ends of the diaphragm rods, in which slots the crank-pins move laterally during their revolution. x, x, show the direction of the feed and exit ways.

The mechanical action or the mode of operation is as follows:—The fluid enters the feedways s, and after passing the valve and suitably constructed ways, enters one of the chambers (say a, fig. 1), presses down the diaphragm and rod, and gives motion to the crank-shaft, valve, and registering apparatus; the fluid being discharged from the chamber b, through one of the exit ports of the valve into the air vessel q; and as this motion brings the feedways into communication with the chamber d, the diaphragm of this chamber commences to descend, and so the motion is continued; the fluid being supplied to and discharged from each of the four chambers alternately; the supply having commenced in one chamber some time before it is cut off from another; and as there are two or more diaphragms and rods, continuous motion, with uniform supply and delivery, is obtained. To prevent rust, it is proposed to deposit a coating of gutta-percha on the interior of these metres.

The patentees claim, "Firstly,—the principle of actuating any description of valve or valves in a gradual and continuous manner, by means of two or more diaphragms, as described. Secondly,—the application to diaphragm metres of an air vessel, into which the fluid shall pass from the measuring chambers previously to its withdrawal for use. And, thirdly,—the construction and use of the within described valve, together with the general principle and arrangement, for the purpose of measuring and obtaining motive power from water and other fluids or vapors.

Specification of a Patent granted to Joseph Sturge, *of Kennington, and* Alfred Sturge, *of Northfleet, for improvements in rotary fluid metres.* [Dated 13th March, 1856.]*

The first part of this invention consists in adapting a modification of a screw in such a manner that its revolutions on its axis shall be the measure of the quantity of fluid passing through a tube or case. Second-

* From Newton's Lond. Journal, January, 1857.

ly, the invention consists in so forming the tube or case, that the fluid shall pass in straight or nearly straight lines through it—causing the revolutions of the screw vanes to be a correct measure of the quantity of fluid passing.

Fig. 1, is a section of the improved metre; and fig. 2, is a detached view of the screw. *a*, *a*, are a series of vanes forming portions of a screw; the spindle to which these vanes are attached is placed perpendicularly in a cylindrical case *b*, rather larger in diameter than the diameter of the screw: the lower end of the spindle rests upon a step, upon which it freely turns, and the other end passes through the top of the case, and is furnished with a worm for communicating motion to the registering apparatus. The upper end of the spindle is furnished either with a collar, which works against the top of the case, or with the centre at the extreme end of the spindle.

fig. 1.

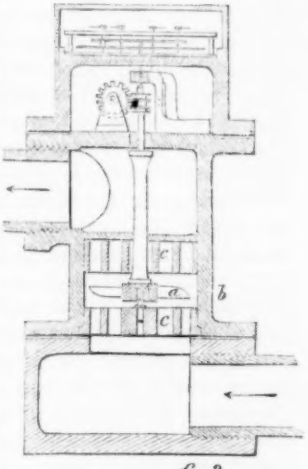
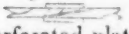


fig 2



The screw can be made by casting the whole of the metal in a mould properly struck, or by stamping each separate vane in a die or dies, and afterwards connecting them to the spindle, by means of a metal boss or central block cast on to them. The case consists of a cylinder *b*, into the upper and lower end of which is introduced a perforated plate or grating *c*. A centre of metal or other suitable hard material for the spindle to revolve upon is fixed either to the lower perforated plate or grating, or to the bottom of the cylinder: the upper plate or grating, as also the top of the cylinder, has a hole in the centre to allow the spindle to pass freely through it. The worm, or the spindle, and the works immediately connected, are covered by a close-fitting cap or cover, which can be filled with oil, and on the top of which are affixed the dials for registering the quantity of fluid passing through the metre. The fluid is admitted underneath the lower perforated plate or grating, and comes in contact with the screw, causing it to revolve and register the amount of water passed through the metre; the fluid then ascends through the upper plate or grating, and whatever motion it may have is changed into a perpendicular motion by passing through the perforated plates or gratings.

The patentees' claims are,—"The use of a blade or blades forming a part or parts of a screw of one or more threads, the axis of which is placed perpendicularly in a chamber through which a column of liquid is made to flow. Secondly,—we claim the use of perforated plates or gratings placed at the upper or lower ends of the case, or both, causing the fluid to flow in perpendicular lines; but we do not confine ourselves to the shape or dimension of the perforations or openings, or, in all cases, to the use of both of the plates; and we prefer that the length of the perforations should be at least twice their diameter."

*Infringement of Howe's Patent for Sewing Machines.—Court of Queen's Bench, Guildhall, Saturday, June 27th, 1857, before Lord Campbell and a Special Jury.—Thomas vs. Reynolds.**

This was an action for the alleged infringement by the defendant, who is a stay manufacturer at Birmingham, of a patent granted to the plaintiff, Mr. W. Thomas, of Cheapside, on the 1st of December, 1846, for "improvements in machinery for sewing or stitching various fabrics." Sir F. Thesiger, Mr. Webster, and Mr. Salter, were Counsel for the plaintiff; and Mr. Atherton, Q.C., Mr. Hugh Hill, Q.C., and Mr. Hindmarch, for the defendant. Prior to the introduction of this patented machinery, which was the invention of an ingenious mechanic, Mr. Howe, of New York, it appears that attempts had been made to embroider or ornament fabrics by working in stitches by mechanical means; and it had also been proposed to unite fabrics by needles and hooks operated by mechanism; but until the introduction of Mr. Howe's invention into this country, no practically useful sewing machine had been seen in England. The plaintiff being largely engaged in the manufacture of goods in which sewing was employed, had the machine brought to his notice, and considering it might be made available for some branches of his business, invited the inventor to this country, and engaged him to adapt his invention to the sewing of stays, which, at that time, were covered with ornamental stitching. This he effected by the use of a traversing frame, which held the work distended, and passed it under the action of the sewing instruments. The sewing machine proper, which formed the chief part of the patent, and which is now known as the "shuttle machine," consists mainly of a grooved needle with an eye near the point to receive a thread, and a shuttle, which in its traverse lays a thread in the loops formed by the needle thread, at the back or front face of the cloth under operation. The needle is connected to and operated by a rock lever, which causes it to pierce and carry the thread through the cloth, and then moves back out of the cloth. During this latter movement, the needle draws its thread into the form of a slack loop, and at that moment the shuttle is driven through the loop and caused to lay a thread in that loop; by which means the loop, on the completion of the return motion of the needle, is retained on the face of the cloth, and a secure stitch is produced. The cloth is then traversed forward the distance of one stitch in length, and the above described action is repeated. While under the action of the needle, the cloth is retained between two metal plates, which greatly facilitate the operations of the needle, and thereby insuring good work. It appeared that machines, possessing some of the essential features of Thomas's machine, had been extensively manufactured in the United States, and imported into this country by Messrs. Grover & Baker, of New York, who were licensees under Howe's American patent, and that, among others, the defendant had purchased such machines and employed them in his business. Attempts had been made to serve Mr. Baker with a notice of action, but failing this, the defendant Rey-

* From Newton's Lond. Jour., August, 1857.

nolds had been sued, and Baker had voluntarily become a party to the suit.

For the defence, it was not attempted to deny the infringement, but the validity of the patent was questioned, on the ground of want of novelty, from the publication of material parts of the plaintiff's invention in the specifications of some eight patents of prior date to the plaintiff's. Of these, the defendant relied mainly on a patent granted to John Duncan, in the year 1804, for a new mode of tambouring or raising flowers, figures, or other ornamental figures upon muslins, &c.; and on another patent granted to Messrs. Fisher & Gibbons in the year 1844, for improvements in the manufacture of figured or ornamented lace, or net, or other fabrics. In Duncan's specification a traversing frame was shown, for holding the cloth at tension, and presenting it to the action of a series of needles and hooks, which were thus enabled to form isolated patterns all over the fabric. This was proved by plaintiff's witnesses to be distinct from his frame, inasmuch as the traverse of Duncan's frame was necessarily limited, to suit the special work required; whereas the plaintiff's would traverse the fabric so as to form a row of stitches from selvage to selvage. And further, Duncan's frame required to be moved by hand after each stitch, while plaintiff's was self-acting, and dependent on the movement of the needle and shuttle. With respect to Fisher & Gibbons's specification, it was contended that that disclosed the use of the needle and shuttle, which formed the second claim under the plaintiff's patent. It was, however, shown by the plaintiff's witnesses, that there was a material difference between the two arrangements. That besides the one having a series of needles attached to a common bar, while in the other there was but one needle, —the form of Fisher & Gibbons's needle was inapplicable to the sewing of seams, and could only be used in connexion with open fabrics like lace. The needle stem was bowed, to allow the shuttle to pass between it and the thread; and it was provided with two eyes, through which the thread passed, and by which it was held across the bow. No slack loop was therefore produced for the shuttle to pass through, as in the plaintiff's arrangement, and moreover, the needle-bar required to receive an irregular or shogging motion, in order to pass the needles through the fabric without tearing it. The form of the stitch was the same in both arrangements, but the mode of producing it was very different. The evidence for the defence went to prove the similarity of Duncan's and the plaintiff's frame for holding and traversing the work, and the anticipation by Fisher & Gibbons of the plaintiff's claim for the needle and shuttle; their specifications having contemplated, in express terms, the sewing of two fabrics together.

The leading counsel having addressed the jury on behalf of their respective clients, the learned judge summed up as follows:—

Summing up.—Lord Campbell.—Gentlemen of the jury, this is an action substantially against Mr. Baker, and I am sorry to be obliged to say, that I do not think he appears before you to-day to very great advantage. A countryman of his, Mr. Howe, is the inventor of a most useful machine; and I must say, that our brethren in America distinguish themselves in every department of human genius, and in none

more remarkably than in invention. Mr. Howe has discovered a sewing machine, the operation of which you have observed, and which seems greatly to improve the material advantages of mankind. It is sold to the plaintiff, who, according to our law, takes out a fresh patent for it,—it never having been practised in England before. The plaintiff is, as far as we can see, in the undisturbed possession of it for ten long years; and then Mr. Baker, of the firm of Grover & Baker, makes an invasion, I must call it, into this country, and sends machines, which were clearly framed according to Howe's invention, and upon which machines Howe's name is actually put; and they sell these machines in Birmingham and other parts of England,—they, no doubt, well knowing that Howe's patent had been purchased by Thomas, and that Thomas had been in the possession of it. Then, notice being served upon Mr. Baker that he would be sued, he leaves this country. Then the plaintiff reluctantly, but necessarily, brings an action against this stay-maker at Birmingham, who was using the machine. Nobody can blame the stay-maker morally; he bought the machine and paid for it, and was using it, but it was necessary to sue him; and then Mr. Baker comes in to defend, and what defence does he set up? Why, first, that he had not infringed Howe's patent, but had made a difference, and therefore that there was no infringement, even if Howe's patent had been valid, he having put upon the machines that he sold the name of Howe. Then his counsel, most able, most learned, and most eloquent, feels that it would not be decent to ask you, a jury of Englishmen, to say that it is not an infringement, when Baker proclaimed to all the world that it was Howe's. It is allowed that there is an infringement, and that if the patent is valid, your verdict must be for the plaintiff. Then it was attempted to be shown, that there was no novelty in Howe's invention which Thomas purchased; and the various specifications that are given notice of are eight in number, but only two are now relied upon; and it is for you to say whether, hearing the evidence and giving all due effect to it, taking care that no bias upon your minds should mislead your judgment, it is for you to say, upon the evidence, and upon listening to the forcible observations you have heard from Mr. Baker's counsel, whether it is proved, to your satisfaction, that either claims No. 2 or No. 3, had been anticipated—had No. 2 been anticipated by Fisher & Gibbons, and No. 3 by Duncan. Now, gentlemen, I was called upon to give an opinion about it;—I think it is a pure question of fact for the jury;—you are the constitutional judges of it, and I beg that you will be governed by your own opinion upon it: I shall merely read to you the claims of No. 2 and No. 3.

No. 2 is amended by a disclaimer, and I ask you to consider what evidence has been given on one side and on the other. No. 2 is in these words: "I claim the application of a shuttle in combination with a needle, as shown in sheet 1 of the drawings." Not several shuttles and needles, but as shown in No. 1 of the drawings; and not for all purposes, but for "forming and securing loops of threads or other substances for the purpose of producing stitches, either to unite or ornament various fabrics, whatever may be the means employed for working such shuttle and needle when employed together." Then, in the disclaimer,

he adds, "I do not claim the use in a machine of several needles and shuttles, nor do I claim any of the mechanical parts, separately, of which the machinery shown in the drawings is composed."

Now, gentlemen, Mr. Carpmael and the witnesses on the part of the plaintiff have said, that Fisher & Gibbons's is essentially different from this No. 2 in Mr. Thomas's specification, and they have given you their reasons. Then, on the other side, there have been witnesses who have stated, very positively, that they are the same: form your own opinion upon it; and though it is a question of fact, and you will be governed by your own opinion, I cannot help saying, that, in my judgment upon the matter, the evidence preponderates in favor of the plaintiff, but do not be governed by that. Then the claim, which is the second ground of objection is, "I claim the construction and use of the sliding frame shown in sheet 2 of the drawings, whereby I am enabled to hold the cloth in such a manner that it can be moved in any required direction to receive straight and curved lines of stitches, and also stitches that will form various patterns of embroidery." Now, it is said that Duncan's machine describes this. It is for you to form your own opinion upon that. I should have thought that Duncan's machine could not properly be called a sewing machine; but that is a matter of fact for your consideration. Mr. Carpmael, and the witnesses for the plaintiff, have stated that it is essentially different from what is stated in No. 3. The defendant's witnesses you have heard, and I must own I was a little surprised to hear that they considered that Duncan's was a sewing machine; but if it be a sewing machine, it is very wonderful that from the year 1804 to the year of grace, 1846, there was no practically useful sewing machine, either in England or America. But one of the witnesses said that a workman reading Duncan's specification would at once find that it was a sewing machine. It is to be regretted that the world for forty years lost the advantage of such a happy invention. But, gentlemen, if you think it is substantially the same, although Mr. Howe did not copy it, or Mr. Thomas did not copy it, the law is, that being substantially the same, and being so disclosed by the specification of 1804, the patent would be invalid. But I cannot help owning that I was a little surprised to hear that they could be the same, if it was necessary in the one always to stop and re-adjust the machine for any change in the pattern; whereas the other could go on and change the fabric to be sewn exactly according to the will of the workman who was superintending the machine. That would have constituted, as one would think, a material difference between them: but one of the witnesses says that that might be done even in Duncan's; that Duncan's will work vertically, laterally, and horizontally. That is contrary to the evidence given on the part of the plaintiff; but you must form your own opinion. If you think that this really was substantially the same, though unknown to Howe, and although it slept for nearly half a century, if it be substantially the same as that which is described in the claim No. 3 of Howe's invention or Thomas's patent, then your verdict upon that will be for the defendant; but if you think there is no satisfactory evidence given to you to show that either No. 2 or No. 3 had been anticipated—that Fisher & Gibbons's patent and Duncan's are materially different from the

description of the claim, either in No. 2 or in No. 3,—then your verdict will be for the plaintiff.

The jury deliberated for a few minutes.

The Foreman.—The jury find a verdict for the plaintiff.

Sir F. Thesiger.—Damages forty shillings. Your Lordship will give the usual certificates.

Lord Campbell.—All certificates.

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*On the Laws of Color.**

[Proceedings of the Royal Institution of Great Britain.]

Mr. Grace Calvert stated that he had three objects in view in this discourse. The first was to make known the laws of color, as discovered by his learned master, M. Chevreul; secondly, to explain their importance in a scientific point of view; and, thirdly, their value to arts and manufactures.

To understand the laws of colors, it is necessary to know the composition of light: Newton was the first person who gave to the world any statement relative to the components of light, which he said consisted of seven colors—red, orange, yellow, green, blue, indigo, and violet. It is now distinctly proved that four of these seven colors of the spectrum are the result of the combination of the three colors now known as the primitive colors, viz: red, blue, and yellow. Thus blue and red combined produce purple or indigo; blue and yellow, green while red and yellow produce orange: these facts being known, it is easy to prove that there are not seven, but three primitive, and four secondary, called complementary colors.

Several proofs can be given that light is composed of three colors only. One of the most simple consists in placing pieces of blue, red, and yellow papers on a circular disk, and rotating it rapidly; the effect to the eye being to produce a disk of white light. If, therefore, the eye can be deceived so readily while the disk travels at so slow a rate, what must necessarily be the case when it is remembered that light proceeds at the rate of 190,000 miles per second?

The rapidity with which light travels is such that the eye is not able to perceive either the blue, red, or yellow, the nerves of the retina not being sensitive enough to receive and convey successively to the mind the three or seven colors of which the light is composed.

Before entering into the laws of color, Mr. Grace Calvert stated that it might be interesting to know what scientific minds had devoted attention to the laws of colors.

Buffon followed Newton, and his researches had special reference to what M. Chevreul had called the "successive contrasts" of colors.

Father Scherffer, a monk, also wrote on the laws of color. Goethe, the poet, also brought his mind to bear upon the subject, and studied it to a great extent. Count Rumford, about the end of the eighteenth century, published several memoirs on the laws of colors. He explained very satisfactorily the "successive" contrast, and arrived at some in-

* From the Lond. Artizan, Aug., 1857.

sight into the "simultaneous" one; still he did not lay down its real laws.

Prieur, Leblanc, Harris, and Field, were also writers of most interesting works on this subject. The reason that they did not arrive at the definite laws of color was because they had not divided those laws into successive, simultaneous, and mixed contrasts. These form the basis of the practical laws of color, and the honor of their discovery is due to M. Chevreul.

The reason why a surface appears white or brilliant is, that a large portion of the light which falls on its surface is reflected on the retina, and in such a quantity as gives to the surface a brilliant aspect; whilst in plain white surfaces, the rays of light being diffused in all directions, and a small portion only arriving to the eye, the surface does not appear brilliant. The influence of colors on these two kinds of surfaces is very different, as may be perceived by the examples round the room, showing the influence of different colors on gold ornaments. When rays of light, instead of being reflected, are absorbed by a surface or substance, it appears black; therefore white and black are not colors, as they are due to the reflection or absorption of undecomposed light. It is easy to understand why a surface appears blue; it is due to the property which the surface has to reflect only blue rays, whilst it absorbs the yellow and red rays; and if a certain portion of light is reflected with one of the colored rays it will decrease its intensity; thus, red rays with white ones produce pink. On the contrary, if a quantity of undecomposed light is absorbed, black is produced, which, by tarnishing the color and making it appear darker, generates dark reds, blues, or yellows. The secondary colors are produced by one of the primitive colors being absorbed and the two others reflected; for example, if red be absorbed, and blue and yellow reflected, the surface appears green. There are two reasons why a perfect blue, yellow, red, cannot be seen, &c. The first is, that surfaces cannot entirely absorb one or two rays and reflect the others. The second is, that when the retina receives the impression of one color, immediately its complementary color is generated; thus, if a blue circle is placed on a perfectly gray surface, an orange hue will be perceived round it; if an orange circle, round it will be noticed a bluish tint; if a red circle, a green; if a greenish yellow circle, a violet; if an orange yellow circle, an indigo; and so on.

The "successive" contrast has long been known; and it consists in the fact that on looking steadfastly for a few minutes on a red surface fixed on a white sheet of paper, and then carrying the eye to another white sheet of paper, there will be perceived on it not a red, but a *green* one; if green, *red;* if purple, *yellow;* if blue, *orange.*

The "simultaneous" contrast is the most interesting and useful to be acquainted with. When two colored surfaces are in juxtaposition, they mutually influence each other,—favorably, if harmonizing colors, or in a contrary manner if discordant; and in such proportion in either case as to be in exact ratio with the quantity of complementary color which is generated in the eye: for example, if two half-sheets of plain tinted paper, one dark green, the other of a brilliant red, are placed side by side on a gray piece of cloth, the colors will be mutually im-

proved in consequence of the green generated by the red surface adding itself to the green of the juxtaposed surface, thus increasing its intensity, the green in its turn augmenting the beauty of the red. This effect can easily be appreciated if two other pieces of paper of the same colors are placed at a short distance from the corresponding influenced ones, as below :—

Red. Red Green. Green.

It is not sufficient merely to place complementary colors side by side to produce harmony of color, since the respective intensities have a most decided influence : thus pink and light green agree, red and dark green also ; but light green and dark red, pink and dark green, do not; and thus to obtain the maximum of effect and perfect harmony, the following colors must be placed side by side, taking into account their exact intensity of shade and tint.

HARMONIZING COLORS.

Primitive Colors.	Complementary Colors.		
Red, . . .	Green, . .	Light Blue, Yellow, Red,	White light.
Blue, . .	Orange, .	Red, Yellow, Blue,	White light.
Yellow-orange, .	Indigo,	Blue, Red, Yellow,	White light.
Greenish-yellow, .	Violet, .	Red, Blue, Yellow,	White light.
Black, . .	White, .	Yellow, Blue, Red,	White light.

If attention is not paid to the arrangement of colors according to the above diagram, instead of their mutually improving each other, they will, on the contrary, lose in beauty ; thus, if blue and purple are placed side by side, the blue throwing its complementary color, orange, upon the purple, will give it a faded appearance ; and the blue receiving the orange yellow of the purple will assume a greenish tinge. The same may be said of yellow and red, if placed in juxtaposition. The red, by throwing its complementary color, green, on the yellow, communicates to it a greenish tinge ; the yellow, by throwing its purple hue, imparts to the red a disagreeable purple appearance. The very great importance of these principles to every one who intends to display or arrange colored goods or fabrics was convincingly shown by Mr. Grace Calvert, from a great variety of embroidered silks (kindly lent by Mr. Henry Houldsworth), calicoes, and paper-hangings, which demonstrated that if these laws are neglected, not only will the labor and talent expended by the manufacturer to produce on a given piece of goods the greatest effect possible, be neutralized, but perhaps lost. It was clearly demonstrated that these effects are not only produced by highly colored surfaces, but also by those whose colors are exceedingly pale, as, for example, light greens, or light blues with buffs, and that even in gray surfaces, as pencil drawings, the contrast of tone between two shades

was distinctly visible. The contrast of tone or tint was most marked when two tints of the same color were juxtaposed, and it was therefore the interest of an artist to pay attention to this principle when employing two tints of the same scale of color. From the "mixed contrast" arises the rule that a brilliant color should never be looked at for any length of time, if its true tint or brilliancy is to be appreciated; for if a piece of red cloth is looked at for a few minutes, green, its complementary color, is generated in the eye, and adding itself to a portion of the red, produces black, which tarnishes the beauty of the red. This contrast explains, too, why the tone of a color is modified, either favorably or otherwise, according to the color which the eye has previously looked at. Favorably, when, for instance, the eye first looks to a yellow surface, and then to a purple one; and unfavorably, when it looks at a blue and then at a purple.

Mr. Grace Calvert also showed that black and white surfaces assume different hues according to the colors placed in juxtaposition with them; for example, black acquires an orange or purple tint if the colors placed beside it are blue or orange; but these effects can be overcome, in the case of these or any colors, by giving to the influenced color a tint similar to that influencing it. Thus, to prevent black becoming orange by its contact with blue, it is merely necessary that the black should be blued, and in such proportion that the amount of blue will neutralize the orange thrown on it by influence, thus producing black. As an instance, to prevent a gray design acquiring a pinkish shade through working it with green, give the gray a greenish hue, which, by neutralizing the pink, will generate white light, and thus preserve the gray.

Mr. Grace Calvert, after explaining the chromatic table of M. Chevreul, which enabled any person at a glance to ascertain what was the complementary color of any of the 13,480 colors which M. Chevreul had distinctly classed in his table, stated that it was of the highest importance to artists to be acquainted with these laws, in order to know at once the exact color, shade, and tint, which would produce the greatest effect when placed beside another color, and that they could save the great length of time which no doubt the great masters lost in ascertaining by experiment those laws, which they could now learn in a few hours by consulting M. Chevreul's work.

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*On the Relations of Gold to Light.**

Prof. Faraday read a paper, "On the Relations of Gold to Light."—This subject was brought forward on the 13th of June of last year, and in the account of that evening, at p. 310, vol. ii. of the *Proceedings of the Royal Institution*, will be found a description of some of the proofs and effects then referred to and illustrated; the following additional remarks will complete the account up to this time. The general relations of *gold leaf* to light were described in the former report. Since then, pure gold leaf has been obtained through the kindness of Mr. Smirke,

* From the Lond. Athenæum, June, 1857.

and the former observations verified. This was the more important in regard to the effect of heat in taking away the green color of the transmitted light, and destroying to a large extent the power of reflexion. The temperature of boiling oil, if continued long enough, is sufficient for this effect; but a higher temperature (far short of fusion) produces it more rapidly. Whether it is the result of a mere breaking up by retraction of a corrugated film, or an allotropic change, is uncertain. Pressure restores the green color; but it also has the like effect upon films obtained by other processes than beating. Corresponding results are produced with other metals. As before stated, *films* of gold may be obtained on a weak solution of the metal, by bringing an atmosphere containing vapors of phosphorus into contact with it. They are produced also when small particles of phosphorus are placed floating on such a solution; and then, as a film differing in thickness is formed, the concentric rings due to Newton's thin plates are produced. These films transmit light of various colors. When heated they become amethystine or ruby; and then when pressed, become green, just as heated gold leaf. This effect of pressure is characteristic of metallic gold, whether it is in leaf, or film, or dust. Gold wire, separated into very fine particles by the electric *deflagration*, produces a deposit on glass, which, being examined, either chemically or physically, proves to be pure metallic gold. This deposit transmits various colored rays: some parts are grey, others green, or amethystine, or even a bright ruby. In order to remove any possibility of a compound of gold, as an oxide, being present, the deflagrations were made upon topaz, mica, and rock crystal, as well as glass, and also in atmospheres of carbonic acid and of hydrogen. Still the results were the same, and ruby gold appeared in one case as much as in another. Being heated, all parts of the deposit became of an amethystine or ruby color; and by pressure these parts could be changed so as to transmit the green ray. The production of *fluids*, consisting of very finely divided particles of gold diffused through water, was spoken of before. These fluids may be of various colors by transmitted light from ruby to blue; the effects being produced only by diffused particles of metallic gold. If a drop of solution of phosphorus in bisulphide of carbon be put into a bottle containing a quart or more of very weak solution of gold, and the whole be agitated, the change is brought about sooner than by the process formerly described; or if a solution of phosphorus in ether be employed, very quickly indeed; so that a few hours standing completes the action. All the preparations have the same qualities as those before described. The differently colored fluids may have the colored particles partially removed by filtration; and so long as the particles are kept by the filter from aggregation, they preserve their ruby or other color unchanged, even though salt be present. If fine isinglass be soaked in water, then warmed to melt it, and one of these rich fluids be added, with agitation, a ruby jelly fluid will be obtained, which, when sufficiently concentrated and cold, supplies a tremulous jelly; and this, when dried, yields a *hard ruby gelatine*, which being soaked in water, becomes tremulous again, and by heat and more water yields a ruby fluid. The dry hard ruby jelly is perfectly analogous to the well-known ruby glass, though often finer in color; and both owe

the color to particles of metallic gold. Animal membranes may in like manner have ruby particles diffused through them, and then are perfectly analogous in their action on light to the gold ruby glass, and from the same cause. When a leaf of beaten gold is held obliquely across a ray of common light, it *polarizes* a portion of it; and the light transmitted is polarized in the same direction as that transmitted by a bundle of thin plates of glass; the effect is produced by the heated leaf as well as by the green leaf, and does not appear to be due to any condition brought on by the heating or to internal structure. When a polarized ray is employed, and the inclined leaf held across it, the ray is affected, and a part passes the analyzer, provided the gold film is inclined in a plane forming an angle of 45° with the plane of polarization. Like effects are produced by the films of gold produced from solution and phosphorus, and also by the deposited dust of gold due to the electric discharge. The same effects are produced by the other deflagrated metals so long as the dusty films are in the metallic state. As these finer preparations could be held in place only on glass or some such substance, and as glass itself had an effect, it was necessary to find a medium in which the power of the glass was nothing; and this was obtained in the bisulphide of carbon. Here the effect of gold upon the ray of light which was unaffected by the glass supporting it was rendered very manifest, not only to a single observer, but also to a large audience. The object of these investigations was to ascertain the varied powers of a substance acting upon light, when its particles were extremely divided, to the exclusion of every other change of constitution. It was hoped that some of the very important differences in the action upon the rays might in this way be referred to the relation in size or in number of the vibrations of the light and the particles of the body, and also to the distance of the latter from each other: and as many of the effects are novel in this point of view, it is hoped that they will be of service to the physical philosopher.

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*Description of an Instrument for Registering Changes of Temperature.**

By Balfour Stewart, Esq.

It lately occurred to the author that advantage might be taken of the capillary action of mercury to construct an instrument similar to a thermometer, but in which the mercury should expand from heat only in one tube, and contract from cold only in another. Accordingly a bulb was blown between two thermometric tubes of differently-sized bores, in such a manner that the tubes lay in one straight line, with the bulb between them. The bulb was then filled with mercury, and the tubes were hermetically sealed at both ends, having been first carefully deprived of air. When the instrument thus constructed was laid in a horizontal position, or nearly so, its action was precisely what the author had hoped; the mercury contracting from cold only in the narrow bore, and expanding from heat only in the wide one,—even when viewed by a microscope of considerable magnifying power.

* From the Lond., Edin., and Dub. Philos. Mag., June, 1857.

It was suggested by Mr. Welsh, Director of the Kew Observatory, that such an instrument might be used for measuring fluctuations of atmospheric temperature; and the following use afterwards occurred to the author. Were it required to exactly estimate the radiating effect of a source of heat, it might perhaps be done by placing this instrument near the source, alternately exposing it to the influence of the calorific rays proceeding from the source, and intercepting these by means of a screen. Owing to the peculiar action of the mercury alluded to, the effect of the rays would be multiplied by the number of times the screen was interposed, provided it were always retained long enough to permit the mercury to cool down. The comparison of an instrument thus acted upon with another similar instrument near it, screened entirely from the source of heat, might furnish us with a means of exactly estimating the heating effect of the source.

The author desires to express his obligation to Mr. Welsh, who, besides finding a use for the instrument, suggested the selection of tubes which appears to answer best, and whose experience was of great assistance in arranging details. He is also indebted to the Kew Committee of the British Association, who kindly examined the instrument, and authorized the construction of several by way of trial. Mr. Casella undertook the operative part in their construction, and his glass-blower, M. J. E. Griffin, took pains to discover some of the circumstances that interfere with the proper action of the instrument, and constructed those that have proved successful.

Without attempting to explain all the peculiarities of this action, it would seem that the mercury is kept in the narrow bore, and prevented from retreating into the bulb, by friction; but, when a moving force is supplied by means of a change of temperature, the motion of the mercury takes place in that direction in which it is least opposed, or most aided, by its capillary action.

As the result obtained is due to the difference between two forces, neither of which is very great, the construction of such an instrument requires care; and the author will now state what appear to be the chief points which demand attention, as derived from his own experience, and that of those who have interested themselves in the construction of the tubes; although this experience is necessarily very limited.

1st. The tubes should be quite clean and free from moisture.

2d. They should be in one straight line, and should expand symmetrically into the bulb.

3d. It seems the best arrangement, to have the narrow tube of flat bore, and not too flat; its greatest width being about equal to the diameter of the wide bore, which should be cylindrical, and neither conical nor flat.

4th. The tubes should be well deprived of air before being sealed. The instrument may be thus graduated.

If, when held vertically, the smaller tube being below, the mercury at the ordinary temperature should fill the lower tube, the bulb and part of the upper tube, the instrument may be pointed off in the same manner as an ordinary thermometer. But, if the mercury under these circumstances be not enough to fill the bulb, the best plan is perhaps to lay

the instrument horizontally in a vessel of water, side by side with a standard thermometer, and, keeping the extremity of the mercury in the one tube at a constant point, to mark off its extremity in the other tube at two or more different temperatures, as shown by the standard thermometer. The length of this tube corresponding to a degree may be then found in the usual way.

The same process may be followed with the other tube. Or, take two points in the first tube—say A and B, the distance between them being, say 50°. Set the mercury at the point A, and mark off its other extremity in the second tube. Set it now at the point B, and mark its extremity in the second tube. The distance between these two points in the second tube will be the length corresponding to 50°.

Graduate the tubes to within a short distance of the bulb, and the best plan is perhaps to number the degrees from one extremity of the instrument, beginning 0...10...20, &c., on to the mark on that side nearest the bulb. Suppose this mark is numbered 100°; then number the mark nearest the bulb on the other side also 100°, and go on upwards numbering 110°, 120°, 130°, &c., until reaching the other extremity of the instrument. In the next place ascertain the temperature of the mercury when it fills the bulb and reaches only to the nearest mark on both sides.

Let this be c°. In taking an observation, note the numbers at both extremities of the mercury, and deduct the less from the greater. To the *positive* remainder add the constant c *with its proper sign*, and the sum will give the true temperature.

Quantity of Ammonia in Dew.

M. Boussingault communicated to the Academy of Sciences of Paris, some interesting determinations as to the quantity of ammonia contained in dew. The dew collected on six different nights between the middle of August and the end of September, at Liebfrauenberg, contained on an average 4·92 milligrammes per litre (about 0·3 grain per gall.) This shows the nutritive effects of heavy dews. M. B. also showed how this ammonia was absorbed by porous substances. The following substances pulverized and exposed to the air for two or three days, absorbed the amounts of the gas noted.

Brick,	0·0000005.	Sand,	0·0000008.
Phosphate of lime,	0·0000008.	Wood, charcoal,	0·0000029.

Repeating his experiments in Paris, obtaining the dew artificially by condensing the moisture of the air upon a cold cylinder of metal, he obtained 10·8 mm. per litre (or ·66 gr. per gall.) of ammonia, and traces of nitric acid. This experiment shows that the atmosphere of our cities is more strongly charged with ammonia, than that of the country.

Smoke-Consuming Furnaces.

M. Dumery, whose furnaces were noticed in our *Journal* (p. 138 of this vol.) as being employed with good effect in the Museum of Natural History at Paris, states to the Academy of Sciences of that city, that he has ap-

plied his arrangements to a passenger locomotive, on the Paris and Meaux railway, and consumes 5 kil. of bituminous coal per square decimetre per hour, (988 lbs. per sq. yd. per hour.) It appears, therefore, from these experiments, which reach nearly the extremes of the scale of consumption of fuel, that the quantity of coal may vary in this apparatus in the ratio of 1 to 15 without the production of smoke.

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*An Improved Electric Lamp.**

Messrs. Lacassagne and Thiers, of Lyons, France, have recently been exhibiting at Paris and Lyons, an electric light of unusual brilliancy, obtained by means of a lamp, which we propose to describe. We regret having to state, before giving our description, that while M. Thiers was last exhibiting the light, about three weeks since, at Lyons, his excellent colleague, M. Lacassagne, died of a disease of the chest with which he had been long afflicted.

The objects of their invention are:—1. To regulate and to keep constant the distance between the two electrodes of electric lights, whatever may be the rapidity of the combustion of the graphite of which they consist. 2. To obtain the constant separation of the electrodes by self-acting means, operating by the action of the current which produces the light, combined with the action of a spring, or with the action of a current derived from the light current. 3. To obviate the necessity of any daily regulating of the apparatus. These results are obtained by the passage of mercury from a reservoir into a receiving cylinder placed underneath. The tendency of the mercury to rise in this cylinder lifts with little friction a piston supporting the lower electrode, which approaches the upper electrode according as the mercury of the reservoir flows down into the cylinder. The action of the electrodes approaching each other is produced by means of a valve opening and closing the tube communicating from the reservoir to the cylinder. This tube passes through one of the soft iron arms of an electro-magnet, which receives its magnetic action from the current producing the light, and which shuts the valve by its action upon an armature of soft iron, which it presses against the valve. The armature which shuts the valve by the action of the current producing the light, is attracted in an opposite direction by a spring, or by a second electro-magnet receiving magnetic action from the derived current, the intensity of which is determined by the resistance offered to it by a coil interposed for that purpose; consequently the passage of the mercury from the reservoir to the cylinder tends to establish itself under the action of the derived current, which opens the valve, and to be interrupted under the action of the principal current, which closes it; the resistance afforded to the derived current is invariable. The resistance afforded to the principal current increases by the widening of the distance or space between the two electrodes, and diminishes by their coming near to each other. If the distance between them increases, the principal current, meeting a greater resistance, diminishes in its intensity, which also diminishes the magnetic power of the electro-magnet due from the principal current which closed the valve; the inten-

* From the Lond. Mech. Mag., June, 1857.

sity of the derived current (the resistance of which is invariable) increases in the same ratio, and tends also by its action on the second electro-magnet to open the valve. If the electrodes approach each other, the contrary effect is produced; the principal current increases by the diminution of resistance through the electrodes, while the derived current diminishes in the same proportion, and tending to close the valve to prevent the further passage of the mercury. It is then evident, that after having determined the resistance of the derived current by the length of the wire of the resisting bobbin or coil, there will be established between the two currents a kind of equilibrium, which will maintain a passage for the exact quantity of mercury that should necessarily flow from the reservoir to the electrode cylinder to lift and regulate the space between the electrodes.

Mozard's Safety Lamp for the use of Miners.•

The object of this lamp is to prevent the collier, whether intentionally or otherwise, from allowing the inflammable gas to come in contact with the flame. The chief feature in the invention is the impossibility of the lamp being opened whilst the light is burning—a feature which renders it worthy of very general adoption. The lamp, in appearance, is like that of Mueseler, but has a chimney in the gauze top, as used by Glover and Cail, and an improved means of raising the wick, which is flat, whereby the collier can obtain a steady bright light for many hours. The rod by which the wick is elevated is so contrived that before the bolt, for preventing the top from being screwed off, can be withdrawn, the wick must be thoroughly lowered into the wick tube, and the flame extinguished. The glass is about 3 in. in diameter and ¼-inch thick, and the supports which carry the upper part of the lamp, as in the Dumesnil, would prevent the glass from being broken, except wilfully. The double plate above the gauze, as in the Mueseler, keeps the hand-ring cool, and the chimney within the gauze effectually prevents the flames being blown through.

Daft's Improvements in Cast Iron Pipes.†

Mr. T. Barnabas Daft, of Dublin, has just filed the specification of a patent for an invention which has for its object the forming of spigot and faucet ends upon cast iron pipes, true enough to make "metal to metal" joints without turning and boring. Chills or iron moulds are made of suitable dimensions and angles, to form a spigot at one end, and a faucet at the other end, of cast iron pipes. They are placed upon the pipe pattern, and moulded therewith, and when the pattern is removed from the sand, the spigot and faucet chills are to be returned to their respective places, and the metal being poured into the mould, a pipe is c st with a spigot at one end, and a faucet at the other. This mould, if the pipe were broken to allow of them being brought together, would accurately fit "metal to metal." Consequently, were a number

• From the Lond. Mining Journal, No. 1139.

† From the Lond. Mech. Mag., Feb., 1857.

of such pipes to be made, they would fit spigot into faucet in a continuous manner, and the accuracy of this joint is found to be such that by simply wetting the surfaces to be united, and driving them home, they rust up in a few days, and form a perfectly steam tight joint, requiring several hundred pounds pressure on the inch to separate them. But generally the joints for gas and water purposes may be made by applying a luting of red lead or other suitable material, and, in some cases, tar will be found to form a sound and durable joint.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 17, 1857.

John C. Cresson, President, in the chair.
John Agnew, Vice President.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary. } present.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Commissioners of Patents, London; Lieut. M. F. Maury; National Observatory, Washington, City D. C.; L. A. Huguet Latour, Esq., Montreal, Lower Canada; Hon. James H. Campbell, M. C., Pottsville, Pennsylvania; Dr. J. Aiken Meigs, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of August was read.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (3) were proposed, and the candidates (6) proposed at the last meeting were duly elected.

S. S. Garrigues called the attention of the members present, to a series of tabular diagrams illustrating a report, parts of which were read, on a new system of decimal weights and measures, proposed by a joint committee of the New York Chamber of Commerce, and The Geographical Statistical Society of New York, as a substitute for our present system of weights and measures, a similar report being also produced by a committee before the late session of the American Pharmaceutical Association held in this city.

Report on Imitation Marble Mantels.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, Imitation Marble Mantels manufactured by the Penrhyn Marble Company of Boston, Massachusetts,

REPORT:—That the patent is for the method of applying the colors by means of a peculiar bath, used in the place of the ordinary "size-bath," long familiar in the manufacture of marble paper. The bath now

patented, consists in a film of Dammara resin floated upon water, which may be broken up into any desired figures, by means of a rod or spatula previously dipped into the desired colors. The bath thus prepared is said to be more manageable than the ordinary one.

The article to be "marbleized" is, after being prepared with the ground color, immersed in the bath, then withdrawn, dried or baked in an oven, and then coated with a proper varnish and again heated.

The articles examined by the Committee are of slate prepared in this way—and they present resources for ornamentation, which are valuable from their comparative cheapness, and the great accuracy of the imitation of which they are capable. The slate is also stronger and less liable to injury than many of the composite marbles which are thus imitated.

Compared with the "marbleized iron," these objects are better imitations of the stone, because the iron has to be covered with a glass to give it the stone surface, and the thickness of this transparent coating shows itself in certain cases; and they are more durable, because the different expansibility by heat of the iron and glass, finally causes the latter to crack, and the iron then rapidly rusts. The new material is free from both these objections, but, on the other hand, the imitations of carved work cannot be done so cheaply as in the iron.

The Committee consider the beauty of the manufacture well deserving of the award of a First Premium from the Committee on Exhibitions.

By order of the Committee,

Philadelphia, Sept. 10th, 1857. WILLIAM HAMILTON, *Actuary.*

BIBLIOGRAPHICAL NOTICE.

The Hand-book of Practical Receipts of every day use; a Manual for the Chemist, Druggist, Medical Practitioner, &c., &c. By THOMAS F. BRANSTON—1st American from 2d London Edition—Philadelphia: Lindsay & Blakiston, 1857.

This is a very useful little book, containing, as its title indicates, a number of valuable practical receipts, arranged alphabetically, and provided with a copious index, so that any one may be easily found, even though it should be doubtful under what title it is to be sought, and a glossary of the terms used in chemistry and medicine, which will give satisfaction to those readers who from time to time are puzzled in their studies by an antiquated or even obsolete technical term.

We wish the publishers had made it in reality what it is in form, an American edition in place of a mere reprint, for there are a great number of practical receipts of great value here, which the English profess to ignore; which might be added to the work, or even substituted for some of the matters of less interest.

We hope the publishers will think over this when a new edition is called for.